October 1996

JCT
JOURNAL OF COATINGS TECHNOLOGY

Convention Issue

Federation of Societies for Coatings Technology
ice
INTERNATIONAL COATINGS EXPO
and Technology Conference

FSCT Annual Meeting
International Coatings Expo and Technology Conference
October 22-25, 1996
McCormick Place North
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Insights & Innovations

SPOTLIGHT
Pan-American Expo Wrap-up

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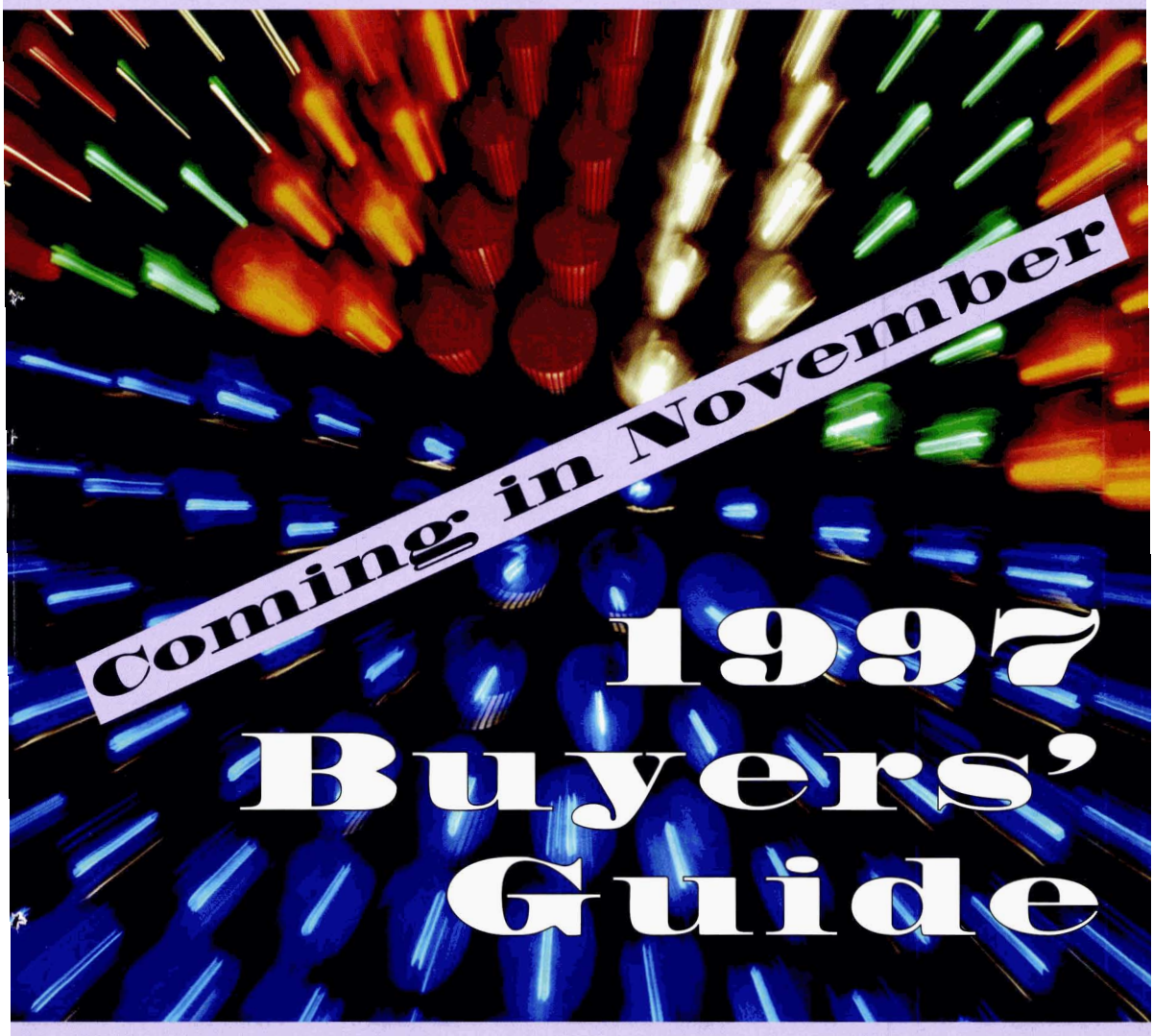

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Technical Articles

Formulation and Production Forum

Federation News

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Guide for Authors

JOURNAL OF COATINGS TECHNOLOGY

GENERAL

The JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology for its membership of approximately 7,000 in 26 Constituent Societies in the United States, Canada, Great Britain, and Mexico. The JOURNAL is devoted to the advancement of knowledge in the science and technology of surface coatings, the materials comprising such coatings, and their use and performance.

The Editors invite submission of original research papers, review papers, and papers under the special headings *Open Forum* and *Back to Basics*, and *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 All manuscripts will be assumed to be previously unpublished writing of the authors, not under consideration for publication elsewhere.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 International Coatings Technology Conference 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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Four complete copies should be sent to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 492 Norristown Rd., Blue Bell, PA 19422. The cover letter should address copyright, clearance, and release issues discussed above and should specify paper category: *Original Research, Reviews, Open Forum*, or *Back to Basics*.

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

...by Constituent Societies For International Coatings Technology Conference Presentation

Ten complete copies of the manuscript are required for committee review. The set of copies should be addressed to Mike Bell, Director of Educational Services, FSCT, 492 Norristown Rd., Blue Bell, PA 19422.

...for Roon Foundation Award Competition

Ten complete copies of the manuscript are required, and should be submitted to Mike Bell at the address previously listed.(For complete details, see "Roon Awards" section of the JOURNAL in the January 1995 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 repititious 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 solicted. Reviews that show how advances from other fields can beneficially be applied to coatings are also desired. Reviews that consist mainly of computer searches with little attempt to integrate or critically evaluate are not solicited.

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

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

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

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

Title

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

Authors' Biographies and Photographs

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

Abstracts

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

Text

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

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

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

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

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

Metric System

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

Tables, Graphs, and Drawings

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

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

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

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

Photographs

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

Color prints and slides are unacceptable.

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

Nomenclature

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

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

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

Equations

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

Summary

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

Acknowledgment

If used, it should follow the summary.

References

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

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

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

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

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

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

OTHER INFORMATION

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

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

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FSCT Board of Directors—1995-96

COMMENT

Planning for the Future

"Strategic Intent: A tangible corporate goal or destiny that represents a stretch for the organization. It also implies a point of view about the competitive position a company hopes to build over the coming decade."

—*Business Week*, Aug. 16, 1996

Although formal organizational changes have yet to be voted on by the Federation's Board of Directors, the FSCT's point of view regarding its future position in the coatings industry is clearly revealed in the pages of this issue. It is a dynamic position in which the FSCT offers the industry increased educational and professional development opportunities and services.

For the first time in its history, the JCT is excited to report on two FSCT-sponsored trade shows. With the first—the Pan-American Coatings Expo held in Mexico City on August 15-17—the FSCT moved beyond its traditional geographical borders. Building on the strength of its international relationships, the Federation co-sponsored this show with the Asociacion Nacional de Fabricantes de Pinturas y Tintas, A.C. (ANAFAPYT) and Instituto Mexicano de Tecnicos en Pinturas y Tintas (IMTPYT). Both in terms of attendance and supplier participation, the Pan-American Coatings Expo far exceeded expectations. As one attendee stated, "The Federation is well-known for quality educational programs and shows. The people at this show came to learn. Who better than the FSCT to provide the means for this learning?" A wrap-up of the Pan-American Expo can be found on pages 11-13.

The second FSCT-sponsored trade show—the International Coatings Expo to be held in Chicago on October 23-25—expands beyond the Federation's traditional "Paint Show" boundaries to encompass all areas of the coatings industry. Once again, a record-breaking number of suppliers will help attendees learn of the latest "insights and innovations" to solve problems that affect their businesses. In addition, new educational opportunities are provided with the Coatings Technology Conference, featuring five one-day pre-convention training seminars as well as four two-day conference courses. Combined with the more familiar Annual Meeting technical presentations, such as the Keynote Address, the Technical Focus Speaker, and the Mattiello Lecture, the Federation event in Chicago is a dynamic step forward. Complete highlights of this exciting event begin on page 24.

A critical stage in defining strategic intent is to determine "core competencies"—important skills which serve as a foundation for an organization's growth. Certainly, as the FSCT Board of Directors continues its strategic planning discussions, the proven expertise of the Federation in providing for the education of its members will be a key factor in setting goals for the future.

Patricia D. Viola
Editor

Technical Abstracts

Spanish translations provided by Jesús Camacho, of Instituto Mexicano de Tecnicos en Pinturas y Tintas.

Extent of Solvents and Chemical Oxygen Demand Build-Up in Boothwater Systems Using Waterborne Paint—S.F. Kia, D.N. Rai, and R.L. Williams

JCT, Vol. 68, No. 861, 87 (Oct. 1996)

The real-time impact of waterborne paint for basecoat on the spray boothwater system was investigated by monitoring the paint spray systems at five automotive assembly plants for periods up to 555 days. The laboratory analyses of the boothwater samples were aimed at evaluating the extent of accumulation of organic material in boothwater. Among the five systems studied, the boothwater average total organic content in terms of chemical oxygen demand (COD) spanned from 3,300 to 16,400 ppm. For systems with a low boothwater replenishment rate and clean water start-up, the boothwater COD showed an almost linear increase with time. Among the systems, the boothwater contained less than 1,000 ppm organic solvents. The boothwater solvents originate primarily from the paint; the contribution from the purge and the cleaning chemicals is small. For all the systems, the solvents in boothwater account for less than 26% of the boothwater COD. The balance of COD is contributed by nonvolatile organics such as paint resins and the organic polymers from the treatment chemicals, which are present in boothwater as fine particles (<0.45 μm).

La Cantidad de Solventes y la Demanda Química de Oxígeno Incrementan el uso de Sistemas de Cortinas de Agua y Pintura Base Agua—S.F. Kia, D.N. Rai, y R.L. Williams

Se investigo, mediante el monitoreo de los sistemas de rocío para pintura en cinco plantas ensambladoras de automoviles por períodos superiores a 555 días, el impacto real-tiempo de pintura base agua para recubrimientos base en los sistema de rocío en cortinas de agua. Los análisis de laboratorio de las muestras de cortina de agua se orientaron a la evaluación de la cantidad de material orgánico acumulado en el sistema. Entre los cinco sistemas estudiados, el contenido total promedio de orgánicos en cortina de agua fué de 3300 a 16400 ppm en términos de COD (Demanada Química de Oxígeno). Para sistemas con una baja taza de llenado de cortina de agua e inicio con agua limpia, el COD mostró un incremento casi lineal con el tiempo. Entre los sistemas, el de contina de agua contenía menos de 1000 ppm de solventes orgánicos. Los solventes de cortina de agua se originan principalmente de la pintura, mientras que la contribución por la purga y químicos de limpieza es pequeña. Para todos los sistemas, los solventes en cortina de agua cuentan por menos del 26% de los COD. El balance de COD esta compuesto por orgánicos no-volátiles tales como resinas de pinturas y los polímeros orgánicos de los químicos de tratamiento, los cuales se presentan como partículas finas (<0.45 μm).

Dielectric and Thermal Analysis of the Film Formation of a Polymer Latex—J.W. Schultz and R.P. Chartoff

JCT, Vol. 68, No. 861, 97 (Oct. 1996)

The real-time kinetics of film formation of a floor polish polymer latex coating has been investigated using dielectric measurements of the ionic conductance. Varying levels of ambient humidity were applied and had a dramatic effect on the drying rate, drying mechanism, and final film thermal and mechanical properties. At humidities below 30%, the drying curves followed a power law time decay with two distinguishable regions. The first region showed a drying rate dependence on the order of t^{-10}, while the second region showed a slower drying rate with a time dependence on the order of t^{-2}. At higher humidities, the curves become more complex. At the highest humidities, film cracking was observed. Besides dielectric analysis, thermal analysis experiments were conducted that indicated film formation continues over very long times (months). The data also indicate that considerable residual stress remains in the dried films even after these long times.

Análisis Térmico y Dielectrico de la Formación de Película de Polímero Latex—J.W. Shultz y R.P. Chaartoff

Se investigo, usando mediciones dielectricas de la conductancia ionica, la cinética real-tiempo de formación de película de un recubrimiento de polímero latex de lustre para pisos. Mediante variaciones ambientales de humedad se obtuvo un efecto dramático en la razón de secado, el mecánismo de secado y las propiedades mecánicas y térmicas finales de la película. A humedades inferiores a 30%, las curvas de secado siguieron un descaecimiento de tiempo regulador de poder con dos regiones delimitadas. La primera región mostró una dependencia de razón de secado del orden de t^{-10}, mientras que la segunda región mostró mucho menor razón de secado con una dependencia de tiempo del orden de t^{-2}. A humedades mayores, las curvas llegaron a ser más complejas. En las humedades más altas se observaron endiduras en la película. Junto con el análisis dieléctrico, se llevaron a cabo experimentos de análsis térmico los cuales indicaron que la formación de película continua a lo largo de períodos muy largos de tiempo (meses). Los datos también indican la presencia contínua de tensión residual considerable en las películas secas aún después de estos tiempos prolongados.

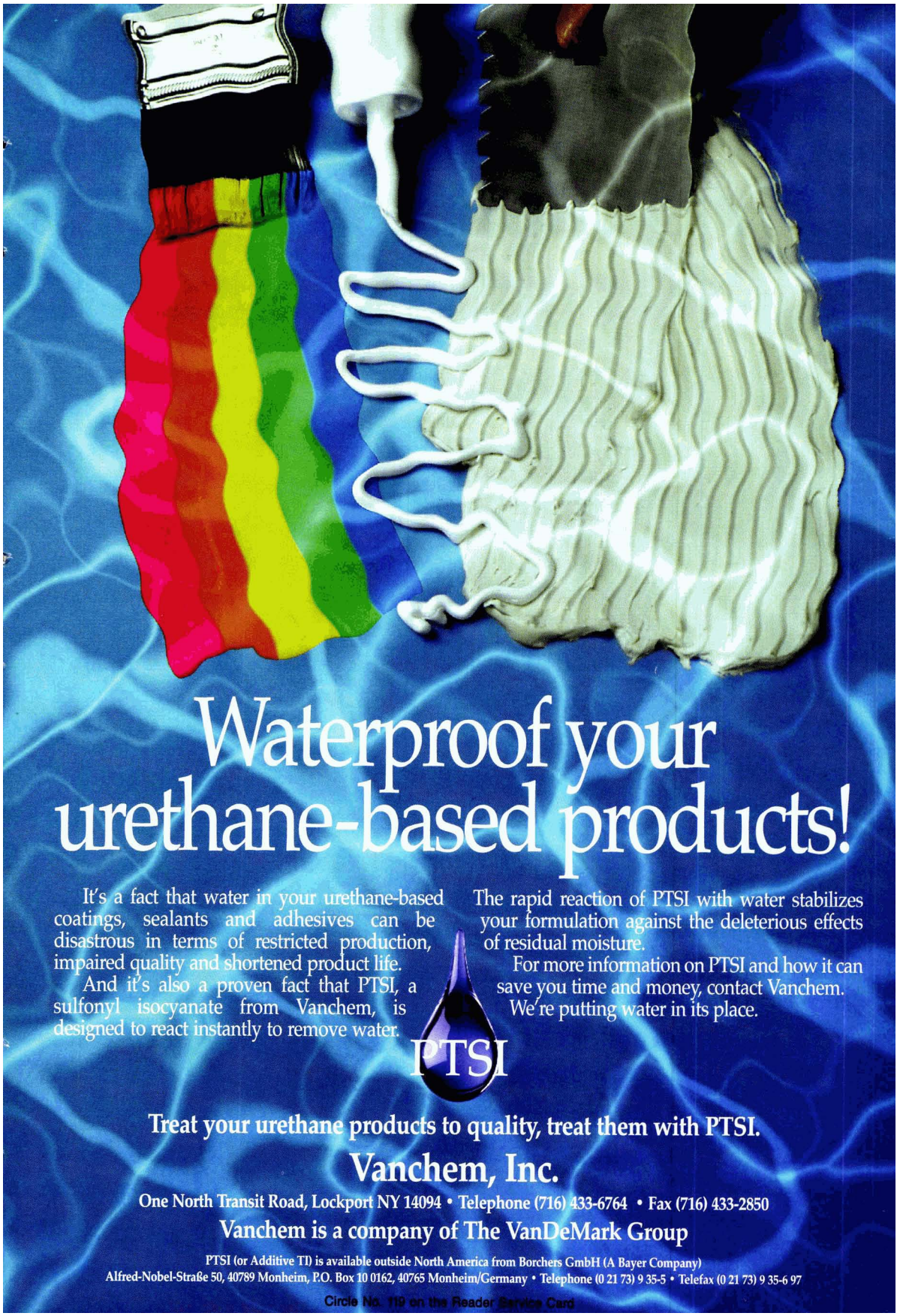
Rheology of Acrylic Powder Coatings—S.G. Yeates et al.

JCT, Vol. 68, No. 861, 107 (Oct. 1996)

Flexibility in the functional design of acrylic powder coatings has enabled a wide range of different crosslinking chemistries to be developed, based upon carboxyl, hydroxyl, and glycidyl functional binders. The use of dynamic viscosity/time (temperature) cure curves is seen as a powerful technique to quantify formulation and resin design parameters. This paper describes how the technique can be used to highlight differences in the available crosslinking chemistries and begins to show how this can be used to predict coating performance on a more quantitative level. A simple model describing the viscosity changes during the curing process is presented, which shows good qualitative agreement with the experimental results.

Reología de Recubrimientos Acrílicos en Polvo—S.G. Yeates et al.

La flexibilidad en el diseño funcional de recubrimientos acrílicos en polvo acerílicos ha habilitado un amplio rango de diferentes químicos de entrecruzamiento para ser desarrollados con base en aglutinantes funcionales glicidil, carbóxilo e hidróxilo. El uso de curvas dinámicas de curado viscocidad/tiempo (temperatura) es visto como una poderosa técnica para cuantificar párametros de formulación y diseño de la resina. Este documento describe como la técnica se usa para diferenciar los químicos estrecruzadores disponibles y mostrar la manera de usarla para predecir el desempeño de un recubrimiento en un nivel cuantitativo mayor. Se presenta un modelo simple que describe los cambios de viscocidad durante el proceso de cura el cual es compatible de manera cualitativa con los resultados experimentales.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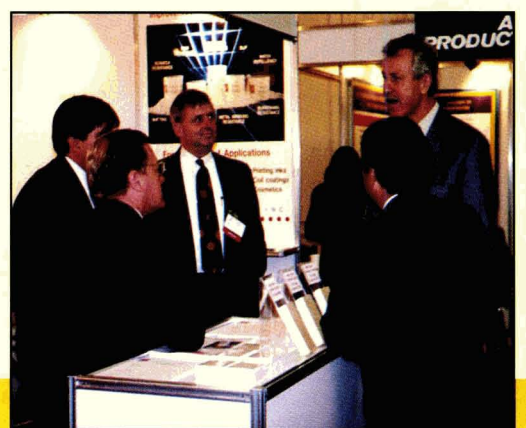
Quimica San Diego S.A. de C.V.
Reacciones Quimicas, S.A. de C.V.
Reichhold Quimica de Mexico, S.A. de C.V.
Reynolds Metals Co.
Rohm and Haas Mexico, S.A. de C.V.
Shamrock Technologies, Inc.
Shell Mexico S.A. de C.V.
Sun Chemical Colores S.A. de C.V.
Tego Chemie Service
Transmisiones y Equipos Ind. S.A. de C.V.
UCB Quimica de Mexico S.A. de C.V.
U.S. Polymers Inc./Accurez Corp.
Versa-Matic Pump Co.
Watson Phillips y Cia. Sucs. S.A. de C.V.
Zeneca Resins



FSCT Co-Sponsors First Pan-American Coatings Expo; Attracts 2000 Attendees to Mexico City, August 15-17

On August 15-17, 1996, the coatings industry travelled "South of the Border," to Mexico City to participate in the first Pan-American Coatings Expo. Co-sponsored by the Federation of Societies for Coatings Technology, ANAFAPYT, and Instituto Mexicano de Técnicos en Pinturas y Tintas (IMTPYT), the Expo exceeded all expectations, attracting 2000 participants. Held at the Sheraton Maria Isabel Hotel, the Expo featured 79 exhibiting companies in 873 sq. meters of space.

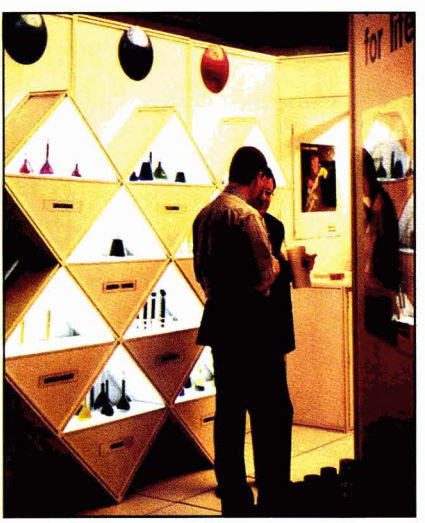
The Pan-American Coatings Expo was held in conjunction with the XXII Annual Convention of ANAFAPYT and the 1996 Technical Conference of the IMTPYT. The conference featured two days of technical presentations, with simultaneous translation in Spanish and English. The presentations were well attended, with over 125 people at each session.

The ANAFAPYT Annual Convention opened with a session featuring welcoming addresses by the presidents of the three organizations—Dr. Darlene Brezinski (FSCT); Ing. Rafael Del Rio Huidobro (ANAFAPYT) and Marcelo E. Herrera Diaz (IMTPYT), as well as representatives from Secofi and Canacintra (the Mexican equivalent of the National Chamber of Commerce and Industrial Growth). Dr. Brezinski welcomed attendees to the Pan-American Expo, noting that "In today's environment, the sharing of information and new technology is critical for everyone in the industry. We can meet the challenges of the future by participating in events such as this."

For attendees the Expo was a prime opportunity to learn about the newest products and technologies. Miguel Guevera H., Technical Director for Mon Mer, S.A. de C.V., stated, "This show definitely helps the industry in Mexico. I have learned a lot!" Jesus Del Villar, Sales Manager of Abasto Quim, S.A. de C.V., enthusiastically echoed this sentiment and was pleased at the advanced level of participation by suppliers as well as the quantity of products shown. "This show helps us to become more aware of products offered by other countries. I found all that I was looking for."

Dr. A. Flores-Vela, Manager for BASF Mexicana, was also excited by the opportunity afforded by the "chance to see all kinds of coatings raw materials and equipment." He came to the Expo interested in gaining information as well as purchasing equipment for his company.

The Pan-American Expo provided a very focused audience—attendees were from the Latin American region, particularly Mexico. Michael J. Dvorchak, Manager of Technology, Wood Coatings, for Bayer's Industrial Chemicals Division, felt this focus was beneficial. As an international company, Bayer is able to support their business units in Mexico through participation in the regional Expo. This was the first time Bayer exhibited in this region and found the experience to be positive. Mr. Dvorchak noted the strong demand for newer technologies, and was pleased in the interest shown in technical information on wood. In addition to ex-



hibiting at the Pan-American Expo, Bayer sponsored the presentation of three papers at the technical conference.

In terms of exhibiting in the Latin American region, Epworth/Morehouse-COWLES has had more experience—the Pan-American Expo marks the third show in which they have participated. Sales Engineer Rocky Courtain, sees this as a continuing effort to strengthen the company's presence in this area. The Pan-American Expo was also a way to showcase the recent merger of Epworth and Morehouse-COWLES and to display their new line of media mills and dissolvers. Mr. Courtain noted that, in Mexico, the Expo provided an excellent way to make contact with people from all levels of an organization. Company owners, presidents, and directors were accompanied by technical people—all those involved in the decision-making process were present on-site.

Julio Aviles, Senior Technical Service Representative for Kronos Inc., agrees. He observed a greater "technology transfer" at the Pan-American Show. "Mexico has an emerging industry. The people come to learn and they have questions to ask. There is a hunger from people to want to know. Often technical people from Mexican companies are not able to attend the U.S. Paint Show. This regional exposition gives people from all levels of a company the opportunity to benefit from attendance."

For Latin American-based companies, the Expo helped to promote products to a wider market in shorter time. Notes Hector Perez Miranda, of Prove-Quim, S.A. de C.V., "Here customers come to us and we are able to help them immediately. In three days, we were able to reach the number of people it would normally take three or four months to contact."

Horacio Ojeda Bernal, Director Comercial for Dupont S.A. de C.V., was also pleased with attendance level, remarking that it was better than other shows in which they had participated. Dupont used the opportunities presented by promoting new developments with their products and to strengthen ties with their local distributors.

As manufacturers of mixing and milling equipment involved in expanding its international base, Premier Mill has had representation in Mexico for several years. Regional Manager Joe Zidik found that most of the attendees who visited the booth were interested in purchasing "for projects in the works or future projects." He found that about 75% of the contacts he made were new and 25% were from the company's existing customer base. "Everybody we expected to be here is here—and more!"

Edward Abendschein, President of New Way Packaging Machinery agreed. "We came to the Show with four specific goals and we met each one: (1) to meet customers we've never met before; (2) to smooth communications between ourselves and existing customers; (3) to support our continuing obligation to customers to provide updated information on products in a way that is cost-effective and dignified; and (4) to remind attendees that someone on their production line may need specific help. This is an excellent way to promote communication between customers and provides a focus for their attention for a few days.

"The FSCT is to be commended for delivering the audience promised. They blanketed information to the industry in the area regarding the existence of the show and its utility to customers."

Actually, the credit for the success of the Pan-American Coatings Expo is shared with members of ANAFAPYT and IMTPYT. Their assistance contributed significantly to the planning and publicity surrounding the Expo. In particular, the efforts of Marcelo E. Herrera Diaz were greatly appreciated.

In Mexico, hospitality is a way of life. Even those of us with poor language skills understand the meaning behind the expression, "Mi casa es su casa." The FSCT extends its thanks to the people of Mexico who truly helped those involved with the first Pan-American Coatings Expo feel at home!

—P. Viola

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

ice INTERNATIONAL COATINGS EXPO AND TECHNOLOGY CONFERENCE

FSCT Electronic Innovations

How to Find All You Need at the 1996 International Coatings Expo

EXPO*Magic* Product Locator/Message Center

Our Product Locators/Message Centers, positioned throughout the International Coatings Expo, will help you locate what you need quickly and easily. EXPO*Magic* is an interactive, multimedia and multi-service stand alone information kiosk. All information in EXPO*Magic* is available in Spanish, French, German, English, Japanese, and Chinese. Features include:

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- *Seminars/Session Locator:* Use EXPO*Magic* to learn the latest scheduling, location, and content information on all FSCT Annual Meeting technical presentations, as well as the Coatings Technology Conference.

Federation of Societies for Coatings Technology

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SLF Invites Prospective Authors to Submit Papers For 15th SLF-Congress in Lillehammer, Norway

The 15th Congress of the Skandinaviska Lacktenikers Förbund (SLF), Copenhagen, Denmark, is scheduled for May 29-June 1, 1997, in Lillehammer, Norway.

The theme of this event is "Environmentally Driven R & D: Durability and Life Cycle Assessments," and SLF is seeking papers focusing on the important environmental topics which are influencing and motivating R&D work within the coating industry today.

Some suggested topics include the following: life cycle analysis; increased durability; "Green Labels"; VOC—emission to atmosphere, emission to indoor climate, high-solid coatings, and VOC-free coatings; and more environmentally friendly raw materials—biocides, APEO substitutes, pigments, packaging, and paint removal.

The deadline for submitting title and abstract is November 15, 1996.

For more information, contact Bent Haflan, Jotun A/S, P.O. Box 2021 Hasle, N-3235, Sandefjord, Norway; Phone: 47 33 45 70 00 or Fax: 47 33 46 11 44.

NDSU to Conduct Two Coatings Short Courses

The Department of Polymers and Coatings at North Dakota State University (NDSU), Fargo, ND, is offering the four-day intensive course "Environmentally Compliant Coatings," on January 21-24, 1997 at the Crowne Plaza Resort, Hilton Head Island, SC. This course is designed for individuals who have experience in coatings research, but want to learn about recent developments in water-reducible, latex, high-solids, powder coatings, radiation curing, corrosion, and mo-dern analysis of coatings.

The course will be taught at the research level with emphasis on the underlying physical, organic, and polymer chemistry. Theoretical considerations will be related to practical problems, and new approaches will be suggested.

In addition, NDSU's Department of Polymers and Coatings is offering a two-week intensive "Coatings Science Course" for all individuals interested in enhancing their current level of knowledge in coatings and paints, or to those who seek broader perspective, understanding, and fundamentals of coatings science. Scheduled for June 2-13, 1997, the course will be held on the Fargo campus.

Information on registration can be obtained from Debbie Shasky, Program Coordinator, (phone: (701) 231-7633; fax: (701) 231-8439; for details on program content contact Prof. Marek W. Urban, Chair of the Polymers and Coatings Department and Short Course Director.

Pacific Northwest Society Issues Call for Papers

The 50th Annual Meeting of the Pacific Northwest Society for Coatings Technology is scheduled for May 8-10, 1997, at the Panamerican Hotel, in Vancouver, British Columbia.

Potential authors are invited to submit papers for presentation at the symposium. The Society is seeking papers related to the chemistry, formulation, physical properties, and application of water-based, low VOC solvent-based, powder, or any other advanced coating systems.

Please submit title, abstract, and author or speaker's name by **November 30, 1996** to the following: Yvon Poitras, Horizon Chemicals Ltd., 10311 Cornerbrook Crescent, Richmond, BC, Canada, V7E 4H5; phone: (604) 271-6772; fax: (604) 271-6774; or Paul Andreassen, Consolidated Coatings Corp., 7651 Vantage Way, #310, Richmond, BC, Canada, V4G 1A6; phone: (604) 946-7626.

PRA Releases Schedule for Surface Coatings Courses

The Paint Research Association (PRA), Teddington, Middlesex, United Kingdom, will conduct the following training courses in surface coatings technology:

"Protective Coatings for Structural Steel"—November 11-13;

"Radiation Curing Technology"—November 18-20; and

"Paint Technology"—December 9-12.

For more information on these courses, contact Sue Benjamin, PRA, 8 Waldegrave Rd., Teddington, Middlesex, TW11 8LD United Kingdom.

The Paint Stone

The PAINT STONE is the official newsletter of the Federation of Societies for Coatings Technology.

Serving its members and the Coatings Industry, *The PAINT STONE* is published at 492 Norristown Rd., Blue Bell, PA 19422. Tele: 610-940-0777; FAX: 610-940-0292.

Submissions for consideration should be forwarded to *The PAINT STONE* at the above address.

ISSN 1073-693X

Route to:

"Finishing Exterior Wood" Explored In 26th Monograph of *FSCT Series*

Today, wood is used for countless interior and exterior applications, including house siding, trim, decks, and fences. If properly treated and maintained, wood can last for centuries. In the most recent addition to the *FSCT Series on Coatings Technology*, author William Feist offers information and advice for obtaining the maximum service life for finished exterior wood products.

"Finishing Exterior Wood" examines the characteristics of wood and wood finishes and their proper application to solid and reconstituted wood products. In this 48-page booklet, the author emphasizes the importance of protecting the wood and wood finish against weathering. The booklet focuses on how manufacturing and construction practices affect the surfaces of wood products, how various types of finishes interact with the surface, and how weathering affects the finished surfaces. In addition, methods for selecting and applying various exterior wood finishes are presented. Finally, Dr. Feist discusses the failure and discoloration of wood finishes, and their cure.

Also included in this monograph is a glossary of wood-related terms, as well as an EPA Consumer Information Sheet related to inorganic arsenical pressure-treated wood.

The *Federation Series on Coatings Technology* is a well recognized educational resource for the industry. The Series is edited by Drs. Thomas J. Miranda and Darlene Brezinski, of Consolidated Research. Among the previously released titles are: "Introduction to Coatings Technology," "Film Formation," "Coating Film Defects," "Powder Coatings," "Introduction to Pigments," and "Silicones in Coatings."

The Series booklets sell for $25 each; the FSCT member discounted price is $15. For a full listing of titles in the Series, or to order, contact Meryl Simon, FSCT, 492 Norristown Rd., Blue Bell, PA 19422-2350.

FSCT to Publish *JCT Buyers' Guide*

As a supplement to its November issue, the JOURNAL OF COATINGS TECHNOLOGY will offer an in-depth profile of suppliers to the paint and coatings industry with its first annual *JCT Buyers' Guide.*

Compiled from the results of a mailing to over 1200 suppliers and distributors, the *1997 JCT Buyers' Guide* will feature supplier charts which provide a product breakdown for each company.

In addition, comprehensive alphabetical listings of suppliers will provide information on corporate addresses, phone numbers and principle contacts. More than 650 product categories will be cross-referenced to direct readers to the suppliers of specific products and services.

The *1997 JCT Buyers' Guide* will be distributed to all members with their November JCT. Additional copies will be available for purchase by non-members.

For information, contact Editor, JCT, 492 Norristown Rd., Blue Bell, PA. Phone (610) 940-0777; FAX: (610) 940-0292.

Inside This Issue

FSCT Welcomes Incoming Society Officers

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✓ International Coatings Expo Check List

Maximize Your Time at the Expo

1: Use the ICE Convention Guide or the on-site electronic Booth Locators to review lists of exhibiting companies and locate the booths you want to visit.

2: Determine the most difficult challenges or problems your company needs to resolve and plan to visit the exhibits that are most likely to provide concrete information or offer products to help you.

3: Stay as comfortable as possible by not carrying around too much.

4: Arrive at the Expo early.

5: Start at the back of the exhibit hall.

6: Carry a small notebook in your pocket.

7: Make it a point to visit the new exhibitors, and don't avoid the smaller booths.

8: Leave enough time to get out and have some fun.

9: When you get home, report to your supervisor and update your co-workers on what you saw and learned.

FSCT Year Book—What Do You Think?

Tom Yates phoned the Federation office as soon as he received his FSCT *Year Book* last year. "I just wanted to tell you folks that this is the best thing you've ever done. The format is so much easier to follow—I can look up people so much faster. Thanks!!!"

Tom's call was only the first of many positive reactions to the changes made in the format of the FSCT annual membership directory.

Through the use of new association management software, the Federation is able to maintain comprehensive member records. This software enabled the FSCT publications staff to produce the annual membership directory and incorporate some format changes.

For the first time, individual members were listed alphabetically by last name, with company names, addresses and appropriate phone and fax numbers. The individual's Society affiliation and membership classification (e.g., active, associate, retired, honorary, etc.), followed. In addition, a second listing was categorized by Society, by membership classification and then by company affiliation, with individuals listed below the company names.

This new, streamlined format did away with the need to refer to an alphabetical index which provided the member with only the Society and the first letter of the company at which the member was employed. Based on the initial members' responses, the publication's revised format worked well.

However, some individuals were less than enthusiastic, citing their need to refer to the directory as a source for corporate addresses, employees, etc. There was also a concern that the method of binding would not hold up over the long haul.

Staff is now in the initial planning stage for the 1997 edition of the FSCT membership directory and we would like to hear directly from you! How do you use the FSCT *Year Book*? Do you like the changes or is there a way to publish the information which is easier for you to use? Please fill in the Faxpoll below and return it to FSCT Headquarters by November 4.

1997 Calendar of Events

February

- **5-7** 24th Annual International Waterborne, High-Solids, and Powder Coatings Symposium. Sponsored by the Southern Society and The University of Southern Mississippi, New Orleans, LA.
- **18-20** Western Coatings Societies' 23rd Biennial Symposium & Show. Sponsored by the Golden Gate, Los Angeles, Pacific Northwest, and Rocky Mountain Societies. Disneyland Hotel and Convention Center, Anaheim, CA.

May

- **8-10** 50th Annual Spring Symposium. Sponsored by the Pacific Northwest Society. Pan Pacific Hotel, Vancouver, British Columbia.
- **12-14** Southern Society Annual Meeting. King and Prince Beach and Golf Resort, St. Simons Island, GA.
- **17-18** FSCT Board of Directors Meeting. Hyatt Regency, Birmingham, England.

June

- **20-21** FSCT Incoming Society Officers Meeting, Marriott, Conshohocken, PA.

FAXPOLL

FAX: (610) 940-0292
Attn: Paint Stone
Return by November 4

1. How often do you refer to the *Year Book*?
   - ❒ frequently ❒ moderately ❒ not at all
2. What is your main purpose for using the *Year Book*
   - ❒ look up name/address/phone of an individual
   - ❒ contact groups of people within a company
3. What size book do you prefer?
   - ❒ 8 in. x 5 3/4 in. (current size)
   - ❒ 7 in. x 9 1/2 in.
   - ❒ 8 1/2 in. x 11 in.
5. What other sections do you refer to?
   - ❒ Executive Committee/Board of Directors Listings
   - ❒ By-Laws and Standing Rules
   - ❒ Description of geographical borders for Societies
   - ❒ Description of FSCT Committees
   - ❒ Description of FSCT Awards
   - ❒ Other _____

COMMENTS:

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United Soybean Board Committee Approves Funding for New Product Development Projects

According to the United Soybean Board (USB), St. Louis, MO, farmers in the United States will invest more than four million dollars during the next year to accelerate the development and commercialization of new soy-based products for industrial uses.

The New Uses Committee of the United Soybean Board recently approved $4.3 million in funding for more than 20 new product development and commercialization projects. The projects cut across public and private institutions, and encompass seven promising industrial markets, including adhesives, lubricants, and paints.

"We have increased our funding to private-sector industrial partners, such as Caterpillar, Inc. and ICI Paints, because they are serious about getting new soy-based industrial products on the market," said Ralph Christensen, Committee Chair. "The only way to have products commercialized that meet industry's needs is by working closely with industry."

A breakdown of the approved projects by market segment is as follows:

ADHESIVES

- Battelle Memorial Institute, Columbus, OH, to do fundamental characterization work of hydrolysis products from soy protein isolates.
- Mississippi State University Forest Products Laboratory, Greenville, MS, to evaluate soy isolates as binders, extenders, and modifiers for wood adhesives.
- University of Minnesota Natural Resources Research Institute, Duluth, MN, to production-test modified soy flour/MDI adhesive in oriented strandboard manufacturing.

COATINGS

- ICI Paints, Strongsville, OH, to evaluate composite soy dispersions for use as paint binders in water.
- Eastern Michigan University, Ypsilanti, MI, to conduct a reactive diluent demonstration project in California.

LUBRICANTS

- Caterpillar, Inc., Peoria, IL, to develop chemically modified soybean oil for lubricant oil basestocks.
- International Lubricants, Inc., Seattle, WA, to identify functional telomers from soybean oil for lubricant formulation, and to evaluate soy-based lubricants for wire rope and for rail, flange, and switch lubricants.

SOLVENTS

- Franmar Chemical, Inc., Normal, IL, to evaluate methyl ester cleaners for screen printing inks and to develop packaging for products containing soy methyl esters.

INKS

- OmniTech International Ltd., Midland, MI, and Wilson Cunningham Co., Fairfax, VA, to define the chemical, physical and economic requirements of soy-based resin polymers used for ink manufacturing.

COMPOSITES

- Robertson Corp., Brownstown, IN, to evaluate soy protein and hulls as additives in adhesives for wood-based building panels.

PLASTICS

- University of Missouri, Columbia, MO, to further explore the development of polyurethanes using soy ingredients.

SURFACTANTS

- University of Southern Mississippi, Hattiesburg, MS, to develop soybean-derived monomers and surfactants for emulsions, polymerization, and detergents.

GENERAL

- OmniTech International Ltd., to conduct market opportunity analysis studies, which update earlier reports and focus on specific targets in the following market segments: adhesives, coatings, plastics, lubricants, and solvents.

"In all these markets, we've been working closely with industry to identify manufacturer and end-user needs," said Mr. Christensen. "The projects selected for funding are aimed at eliminating technical and economic barriers that stand between promising product concepts and commercialization."

He anticipates commercialization of some soy-based products as early as 1997.

The USB New Uses Committee funds product development and commercialization activities to advance soy-based product technology in the wood adhesives, plastics, building materials and specialty chemical markets.

Eastman Chemical Integrates Ink Business into New Unit

Eastman Chemical Co., Kingsport, TN, has exited the commercial pigmented ink business. The company's commercial ink unit, formerly known as Eastek Inks, is now completely integrated into the Ink and Pigment Business unit. This new business unit is focused on supplying water-based and solvent-borne products to the inks market.

"The new, non-pigmented product mix will include the Eastek® 1000 series-100% polyester polymers; the Eastek 2000 series—hybrids of polyesters and other resin systems; as well as Eastman's line of primers, extenders, and overprints. The company will continue to supply cellulose esters, solvents, SAIB, TXIB™ plasticizer and Epolene® polymers to the ink industry. All of these products will be sold through established sales and customer service representatives," according to Jim Dickert, Vice President and General Manager of the Coatings, Inks, and Resins Business Organization.

The Technical Service and Development laboratories for waterborne and solvent-based products have been combined and the new lab is responsible for all products sold to this industry.

Companies Launch Web Sites

Company	Web Site
The Aaron Companies Bensenville, IL	http://www.aaronequip.com
BatchMaster Software Corp. Seal Beach, CA	http://www.batchmaster.com
Chemical Leaman Exton, PA	http://www.cltl.com
DeFelsko Corp. Ogdensburg, NY	http://www.defelsko.com
Degussa Corp. Ridgefield Park, NJ	http://www.degussa.com
Environmental Resources Mgmt. Exton, PA	http://www.erm.com
W.W. Grainger, Inc. Chicago, IL	http://www.grainger.com
Great Western Mfg. Co., Inc. Mission, KS	http://www.gwmfg.com
H. Marcel Guest Ltd. Manchester, United Kingdom	http:/www.h-marcel-guest.com
Inter-Society Color Council Reston, VA	http://www.iscc.org
Kronos, Inc. Houston, TX	http://www.nl-ind.com/kronos
Macbeth New Windsor, NY	http://www.macbethdiv.com
NDPA St. Louis, MO	http://www.hygexpo.com/ndpa/
New Logic International Emeryville, CA	http://www.vsep.com
Pall Corp. Port Washington, NY	http://www.pall.com
Rheometric Scientific, Inc. Piscataway, NJ	http://www.rheosci.com
Spectra-Tech Inc. Shelton, CT	http://www.spectra-tech.com

Plastics Resins Production Increases 9.7% in June 1996

Production of plastics resins totaled 6.2 billion pounds in June 1996, an increase of 9.7% over June 1995, according to statistics released by The Society of the Plastics Industry's (SPI) committee on Resins.

Production figures for June 1996 were down 1.9% from those of May. Production in 1996 year-to-date totaled 36.4 billion pounds, a 4.7 increase over the same six-month period in 1995.

Sales and captive (internal) use of plastics resins in June 1996 totaled 6.3 billion pounds, an increase of 11.5% over the same month one year ago. June 1996 sales and captive use was down 5.6% from the total of the previous month. Sales and captive use in 1996 year-to-date totaled 38.7 billion pounds, a 10.6% increase from the same six-moth period in 1995.

June 1996 figures are based on primary data on selected major plastics materials as compiled by Association Services, LLC for SPI's Committee on Resin Statistics.

Hüls America Inc. To Market Rohm Tech Inc.'s Products

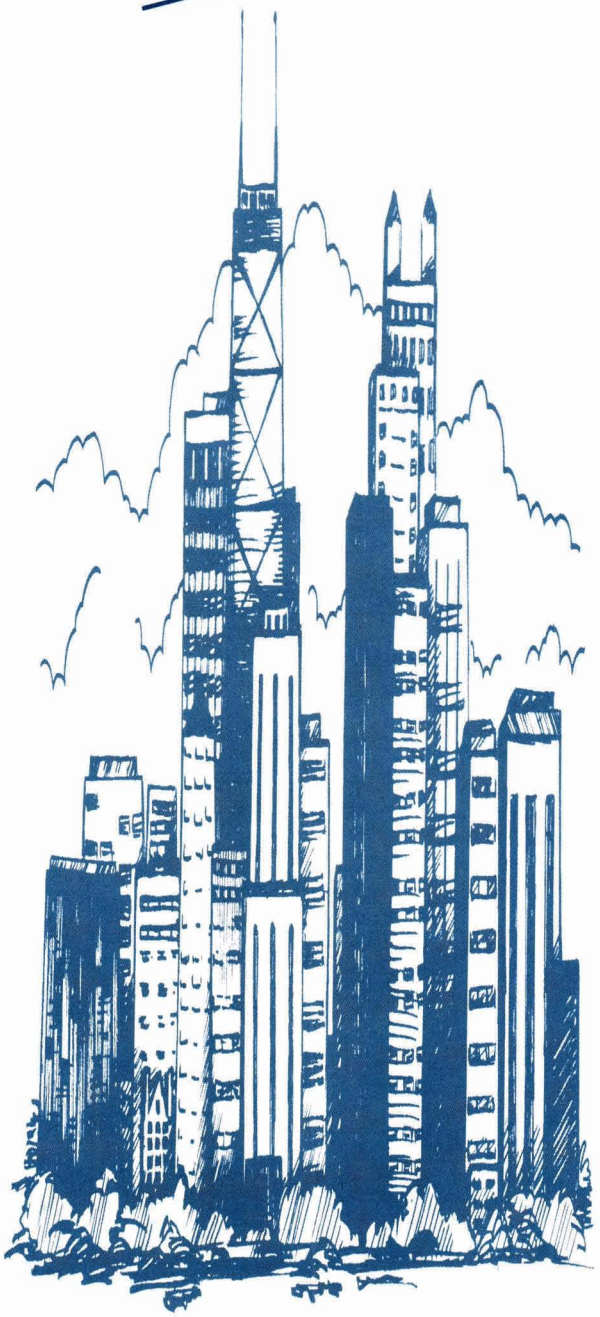
Hüls America Inc., Somerset, NJ, has integrated the sales and marketing of Rohm Tech Inc.'s, Fitchburg, MA, methacrylate monomers, polyalkyl methacrylate (PAMA) powders, methacrylic polymers including Rohagum®, Rohasol®, Rohadon®, and Eudragit® resins into its Coatings Raw Materials operations.

Rohm Tech Inc.'s emulsion polymer products will remain available through Rohm Tech.

Buckman Labs Receives Yacatecuhtli Award

Buckman Laboratories S.A. de C.V., Cuernavaca, Mexico, was awarded the Yacatecuhtli Award in recognition of their exporting activities for 1995 among middle-sized companies in the State of Morelos.

Program



Federation of Societies for Coatings Technology Presents

ice
INTERNATIONAL COATINGS EXPO

1996

FSCT Annual Meeting

International Coatings Expo

Technology Conference

October 22-25, 1996
McCormick Place North
Chicago, Illinois

FSCT

- Annual Meeting
- International Coatings Expo
- Coatings Technology Conference

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

ice INTERNATIONAL COATINGS EXPO AND TECHNOLOGY CONFERENCE

October 22-25, 1996
McCormick Place North
Chicago, Illinois

Program/ICE Exhibitor Listings

"Insights and Innovations"

International Coatings Expo (ICE)—*the new "PAINT SHOW"*

Encompassing the spectrum of coatings manufacturing, the new format of the FSCT's annual convention will feature a record-breaking exhibition of over 300 supplier companies in the International Coatings Expo. Held in conjunction with the FSCT Annual Meeting Technical Program, "ICE" will present over 100,000 square feet of exhibits. Come meet these suppliers face-to-face. Problem-solving opportunities abound at "ICE '96"!

Coatings Technology Conference

NEW

New to the 1996 FSCT Annual Meeting is the International Coatings Technology Conference. The conference provides a forum for learning at all levels of the coatings industry, from the newly hired technician to top level management. Each course has been designed for specific areas of your organization, including lab personnel, sales and marketing staff, manufacturing, quality assurance and research and development.

Technical Conference program includes:

- **Five Pre-Convention Training Seminars**, on Tuesday, October 22.
- **An Executive Forum**, covering Technology Management, Tuesday, October 22.
- **Four two-day Coatings Technology Conference Courses**, Wednesday and Thursday, October 23-24, 1996.
- **Complimentary Attendance to the International Coatings Expo and FSCT Annual Meeting Technical Presentations** for all one- and two-day and full conference registrations.
- **Set of Course Materials** is provided to the attendees of each individual program.

Federation of Societies for Coatings Technology
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Pre-Convention Training Seminars and Conference Courses require separate admission fees from general ICE registration.

1996 Annual Meeting Technical Program

"Insights and Innovations"

Wednesday, October 23, 1996

Opening Session
8:30 a.m.
McCormick Place East—Room E450

Seventy-fourth Annual Meeting of the Federation of Societies for Coatings Technology opened by President Darlene Brezinski

FSCT Heckel Award

Presentation of George Baugh Heckel Award, FSCT's highest honor, will be made to **George R. Pilcher,** of Akzo Nobel Coatings Inc.

E.W. Fasig Keynote Address

Keynote Speaker—**Ten Thousand Dollar Per Square Centimeter Coatings**—Walter C. McCrone, of McCrone Research Institute

There are many compositions of coatings useful for protection, for aesthetics, and for providing properties such as electrical conductivity, adhesion, etc. None, however, is more expensive than some of the aesthetic coatings. Coatings applied to a canvas by Leonardo da Vinci have sold for more than $20,000/cm. Other old-masters are not far from the same price range. One result of this is the growing temptation for some modern artists to "change their name" to Rembrandt, Titian, Raphael— or even Leonardo. There is an increasing need for scientific techniques to detect art forgeries. Mr. McCrone's presentation describes how these complex coatings are analyzed by Polarized Light Microscopy supplemented by Fourier Transform Infrared Absorption and Scanning Electron Microscopy with Energy Dispersion X-ray analysis to detect these mis-attributions.

Technical Focus Speaker
1:00 p.m.- 2:00 p.m.
McCormick Place North—Room 230

Pigment Flocculation is a Figment of Your Imagination—F. Louis Floyd, Duron, Inc.

Roon Award Competition Papers—
2:00-4:00 p.m.
McCormick Place North—Room 230

A Unifying Model for Understanding Associative Thickener Influences on Waterborne Coatings—J. Edward Glass, Mao Chen and Zeying Ma, North Dakota State University, and Robert Buchacek and Jack Dickinson, DuPont

Rheological Changes During the Drying of a Waterborne Latex Coating—Matthew Gebhard, Rohm and Haas Co. and Frank Löfflath, PPG Industries, Inc.

New Developments in Acrylate Modified Epoxy-Amine Cure Coatings—Michael A. Bailey, Tim Cauffman and Richard Costin, Sartomer Co.

Mechanistic Considerations of Particle Size Effects on Film Properties of Hard/Soft Latex Blends—Sarah Eckersley and Bradley Helmer, The Dow Chemical Co.

Thursday, October 24, 1996

APJ/A.F. Voss Award Competition Papers
9:00 a.m.-10:00 a.m.
McCormick Place North—Room 230

An Investigation of the Effects of Formulation on Selected Properties of UV Curable IPN Coatings—Detroit Society for Coatings Technology

Direct VOC Analysis of Water-Based Coatings by Solid Phase Micro Extraction and Gas Chromatography—Los Angeles Society for Coatings Technology

FSCT Annual Industry Luncheon
12:00 noon
McCormick Place East—Room E451

Luncheon Speaker—Bettina Gregory, ABC News, Senior Correspondent

International Papers I
2:30 p.m.-3:30 p.m.
McCormick Place North—Room 230

Component Thinking in Paint Production—Carola Grundfelt-Forsius, Tikkurila OY, *(presented on behalf of SLF)*

High Durable Coating Systems for Steel Structures and Their Performances—Hiroyuki Tanabe, Masanori Nagai and Masafumi Kano, Dai Nippon Toryo Co., Ltd. *(presented on behalf of JSCM)*

Friday, October 25, 1996

FSCT Annual Business Meeting
9:00 a.m.-10:00 a.m.
McCormick Place North—Room 224

International Papers II
9:00 a.m.-10:30 a.m.
McCormick Place North—Room 229

Environment-Friendly Antifouling Paint—A. Perichaud and J. Coquillaud, Catalyse Company *(presented on behalf of AFTPVA Section of FATIPEC)*

Solventless Aliphatic Polyisocyanates Hardeners for Low VOC PU Formulations in the Coatings Industry—Pierre Ardaud and Eugenie Perroud, Rhone-Poulenc

Counting the Cost of the Legislation—Simon G. Lawrence, Ciba Pigments Division *(presented on behalf of OCCA)*

Mattiello Memorial Lecture
10:30 a.m.-11:30 a.m.
McCormick Place North—Room 230

Predicting In-Service Weatherability of Automotive Coatings: A New Approach—David R. Bauer, Ford Motor Co.

Abstracts of Annual Meeting Presentations

Wednesday, October 23, 1996

E.W. Fasig Keynote Address
8:30 a.m.
McCormick Place East—Room E450

Ten Thousand Dollar Per Square Centimeter Coatings

Walter C. McCrone, McCrone Research Institute

There are many compositions of coatings used for protection, for aesthetics, and to provide useful properties such as electric conductivity, adhesion, abrasion, etc. None, however, is more expensive than some of the aesthetic coatings. Coatings applied to a canvas by Leonardo da Vinci have sold for more than $20,000/cm. Other old-masters Rembrandt, Titian, Raphael, etc., are not far from the same price range. One results of this is the growing temptation for some modern artists to "change their name" to Rem-brandt, Titian, and Raphael, even to Leonardo. There is an increasing need for scientific techniques to detect art forgeries. These rather complex coatings are analyzed by Polarized Light Microscopy supplemented by Fourier Transform Infrared Absorption and Scanning Electron Microscopy with Energy Dispersion X-ray analysis to detect these misattributions.

Technical Focus Speaker
1:00 p.m. - 2:00 p.m.
McCormick Place North—Room 230

Pigment Flocculation is a Figment of Your Imagination

F. Louis Floyd, The Glidden Co.

The coatings industry annually spends millions of dollars on R&D, process engineering, and production troubleshooting trying to increase the efficiency of utilization of titanium dioxide pigments. This is driven by the common assumption that a typical dried paint film contains flocculated pigment, which originates from a less-than-perfect dispersion in the wet state. Evidence for this assumption derives from such measurements as opacity, color and gloss; coupled with microscopic observations which show particle-particle contact in a dried films. These observations are paired with models of "perfect" dispersion in the solid state, which clearly show that the contributions from TiO_2 are below theoretical levels. But does this mean that flocculation is the cause? I believe not. I believe that:

- it is our mind-set regarding what "random" looks like which is at fault;
- the models we're using to describe perfect dispersion are flawed;
- we have been utilizing our TiO_2 as efficiently as is possible for a random system; and
- further improvements will require a departure from random systems to more ordered systems, which is the opposite direction from most research going on presently.

If this view is correct, it means that our industry, by pursuing ever better pigment dispersion in the wet state, has been working on the wrong issues.

Roon Award Competition
2:00 p.m.-4:00 p.m.
McCormick Place North—Room 230

A Unifying Model for Understanding Associative Thickener Influences on Waterborne Coatings

J. Edward Glass, Mao Chen, and Zeying Ma, North Dakota State University, and Robert Buchacek and Jack Dickinson, DuPont

The structural features of associative thickeners influence their viscosifying properties in neat and surfactant containing aqueous solutions and in architectural coating formulations. Proprietary commercial materials with unknown structural features provide an array of performance variations. Our understanding of the phenomena based on model associative thickener structures is presented. These studies provide general concepts in aqueous solutions, but they do not provide a quantitative mode for understanding the influence of associative thickeners in coating formulations or on applied film properties. To provide a more quantitative description, the interactions of associative thickeners with the disperse phases of coatings, i.e., the film former and TiO_2, are considered in this study. This requires a knowledge of the free surfactant concentration in the formulation that depends on the residual amount present in the latex, and the amounts added with the pigment grind, colorant, etc. It also depends on the type of stabilizer, grafted or adsorbed, on the surfaces of the film former and TiO_2. With the organic dispersion this would include the amount of methacrylic or monomeric acid or protective colloid [i.e., cellulose ether or poly(vinyl alcohol)] used in the film former synthesis and the composition of the organic latex binder. With the pigment, this includes an understanding of the type of inorganic layer (aluminum, silicon, and zirconium oxides), the type of oligomeric acid organic dispersant, and the surfactants employed. The competitive interaction of the surfactants and associative thickeners types for the surface of both disperse phases is a key variable. These interactions are discussed in an effort to define an encompassing model for understanding coating properties.

Rheological Changes During the Drying of a Waterborne Latex Coating

Matthew Gebhard, Rohm and Haas Co., and Frank Löfflath, PPG Industries (France), S.A.

Increases in the limiting low shear viscosity occurring during the initial stages of drying of a water-based latex film were examined for two lattices formulated at varying pH's with a variety of cosolvents and neutralizing agents. Additionally, the rate of water and cosolvent evaporation were determined as a function of temperature and relative humidity. Water was found to evaporate from the films as if it were pure water with an activity coefficient of 1 and a heat vaporization equivalent to pure water. To characterize the magnitude of the viscosity changes, the limiting low shear viscosities during drying of a water-based latex film were examined using a

creep experiment at 0.1 Pa. The increase in viscosity during drying is explained by the volume packing models of Krieger and Dougherty or De Kruif. The viscosity measurements were used to determine the ratio between the volume and weight fraction. For several of the films in this study, the ratio between the volume and weight fraction was not a static parameter, and during the drying process an abnormally large drop in the effective volume occupied by the latex was observed. This behavior was exaggerated for the samples containing either ethylene glycol monobutyl ether (EB) or NH_4OH. The former can be understood based on high volatility of EB, while the latter cannot be explained purely by the volatility of NH_3, and surprisingly indicates that NH_4OH substantially suppresses viscosity during drying.

New Developments in Acrylate Modified Epoxy-Amine Cure Coatings

Michael A. Bailey, Tim Cauffman, and Richard Costin, Sartomer Co.

A new line of low viscosity, low volatility acrylic monomers and oligomers containing highly reactive C=C double bonds has been developed. These products readily undergo Michael addition polymerization reactions with conventional amine curing agents. When an acrylic monomer/oligomer is used as a modifier for an epoxy resin in a high solids coating formulation, the amine curing agent reacts with the epy resin via direct addition and the acrylic monomer/oligomer via Michael addition to give a highly crosslinked thermoset network. In this system, the acrylic component provides viscosity reduction and reinforces the epoxy crosslink network, thereby, contributing to the final properties of the coating. Hence, the acrylic monomer not only functions as a diluent for the epy resin, but becomes part of the coating as well. In this way, very low VOC, high performance epoxy based systems can be formulated.

Mechanistic Considerations of Particle Size Effects on Film Properties of Hard/Soft Latex Blends

Sarah T. Eckersley and Bradley J. Helmer, The Dow Chemical Co.

Blends of hard (T_g ~ 60°C) and soft (T_g ~ 0°C) latexes were studied as a function of particle size ratio (R_{soft}/R_{hard}) and blend ratio (mass soft phase/mass hard phase). Addition of hard phase latex to the soft film forming latex significantly improved block resistance, even at blend ratios as low as 70/30. Film properties (minimum film temperature (MFT), tensile strength and tensile elongation) were not sacrificed, except at high concentrations of the hard phase (50/50). For a given blend ratio, the particle size ratio had a dramatic effect on the block resistance. For a 70/30 blend ratio, the block resistance of a blend with R_{soft}/R_{hard} = 4.0 was equivalent to that of a control latex having the same overall composition, but with a minimum film temperature 20°C higher than the blend. A 70/30 with R_{soft}/R_{hard} = 0.26 exhibited block resistance that was far inferior to the control.

The phenomenon can be explained in terms of the bulk and surface contributions to adhesion. The hard phase acts as inert reinforcing filler, thus increasing the elastic modulus (G') of the film. The magnitude of G' was found to increase with increasing R_{soft}/R_{hard}, an effect that is consistent with percolation theory. The effect of particle size ratio on the surface contribution to adhesion can be explained by particle packing. Visual models indicate that a high apparent surface concentration of hard particles would be expected for a large value of R_{soft}/R_{hard}, given ideal packing conditions. This effect was confirmed by scanning electron microscopy.

Thursday, October 24, 1996

AJP/Voss Award Competition Papers
9:00 a.m.-10:00a.m.
McCormick Place North—Room 230

An Investigation of the Effects of Formulation on Selected Properties of UV Curable IPN Coatings

Detroit Society for Coatings Technology (Latoska Price, Akzo Nobel Coatings, Inc.)

UV curable coatings based on urethane-acrylic resins were prepared by free radical or cationic polymerization. The effects of photoinitiators on the curing reaction, the effects of polyol types and dimethylopropionic acid (DPMA) amounts on the properties of UV curable coatings prepared by free radical polymerization (UVF) were investigated. The effects of photoinitiators on the curing reaction of UV curable coatings prepared by cationic polymerization (UVC) and the effects of post curing conditions on the properties of UVC were evaluated. The interpenetrating polymer network (IPN) containing UV curable coatings (UVIPN) which were composed of UVF and UVC at different ratios (by weight) were prepared and both morphologies and properties of UVIPN with varied UVF/UVC ratios were studied.

Direct VOC Analysis of Water-Based Coatings by Solid Phase Micro Extraction and Gas Chromatography

Los Angeles Society for Coatings Technology (Max T. Wills, Cal Poly State University)

The identify of the solvents present in water-based coating may be determined by sampling the coating head space using solid phase micro extraction (SPME) followed by capillary gas chromatography (GC) with either flame ionization or mass spectral detection. Using this technique, high boiling solvents such as Texanol and butyl carbitol were identified at concentrations as low as 0.1%. Individual solvents identified by SPME were then quantified by separate GC analysis of coating samples diluted with either methanol or dimethylformamide. Using the SPME technique made it possible to exclude GC peaks, formed by thermal decomposition of the resin in the injection port of the gas chromatograph, from the calculation of total VOC.

Residual solvent in dried paint films was examined. We found that high boiling solvents such as Texanol and dibutyl phthalate were not completely lost from films dried at 110°C for one hour (ASTM Method D 2369). It was found that triethylamine evaporates from coatings containing triethylamine-neutralized resins under the test conditions of ASTM Method D 2369, by thermal decomposition at elevated temperature, but does not evaporate from coatings cured at ambient temperature. Other amine-neutralized resins may exhibit this same behavior.

Several water based coatings of known composition were analyzed by direct capillary gas chromatography of solutions of the coatings in methanol or dimethylformamide and excellent agreement with theoretical VOC values was obtained. In addition, fifty-two water based architectural and industrial maintenance coatings were analyzed by a combination of SPME/GC and direct GC of solutions in methanol and/or dimethylformamide and the results compared with reported values. The SPME/GC method appears to be especially suitable for the analysis of low VOC content water based coatings, for which EPA Method 24 often gives poor results. The identification and quantitation of exempt solvents may be performed easily with this method.

International Papers I
2:30 p.m.-3:30 p.m.
McCormick Place North
Room 230

Component Thinking in Paint Production

Carola Grundfelt-Forsius, Tikkurila Oy (presented on behalf of SLF)

A procedure is described that streamlines the production of paints and coatings in different qualities and colors. This method is a step further from the long-known mixing of base paints and colorants practiced in the U.S. and Scandinavia for decades. The base paints have now been split into components which when mixed with the colorants, components as well, give various types of paint in any desired color.

Instead of paints or base paints, only intermediates are prepared, controlled, and stored in the factory. The desired paint is then mixed from these strictly controlled components as per order.

The main benefit of this component thinking is the reduction of items in stock and the easiness of customizing certain properties of coatings. Even if the volume of the final product is small, the components are continuously made in large volumes because they are ingredients in many products. Therefore, we can benefit from the learning curve, resulting in further reduced production cost.

The mixing can be done in plant or as a remote operation. It can be made as in batch mixing or in-can mixing, depending on the order size.

The method of component mixing is suitable for both architectural and industrial coatings where special properties are desired, even for small to medium sized orders. It requires a new thinking in the product development of paints. The chemists no longer develop ready made paints but components suitable for several paints.

Component mixing gives new dimensions to paint development and production. It also gives new visions for know how management.

Friday, October 25, 1996

International Papers II
9:00 a.m.-10:30 a.m.
McCormick Place North—Room 229

Solventless Aliphatic Polyisocyanates Hardeners for Low VOC PU Formulations in the Coating Industry

Pierre Ardaud and Eugenie Perroud, Rhône Poulenc (presented on behalf of FATIPEC)

Solvent-based nonyellowing 2K polyurethanes are presenting the best compromise of performance in many coatings applications. The qualities of polyurethane coatings are now well established and such systems are present worldwide where flexibility, gloss retention, and weather resistance of the coatings are required.

Performance can be obtained in very different conditions through the wide choice of hydroxylated resins proposed on the market which allows to find a very efficient solution adapted to every case. Evolution of the regulations are pushing to decrease solvent amount in formulation and both resin producers and paint manufacturers are adapting their range to these new demands.

In this study, we present the incidence of the right choice of the polyisocyanate hardener in PU formulation in order to reach high-solids content as expected by the coating industry.

Counting the Cost of the Legislation

S.G. Lawrence, Ciba Pigments Division (presented on behalf of OCCA)

In spite of a trend for the U.S. and Eastern Europe to talk together and attempt to bring their chemical legislation into some sort of conformity, there are still significant differences in the data required, for example to place a product on the market or to gain approval for indirect food contact usage.

If we move away from these two geographical areas and consider the general chemical regulations and impurity limits that need to be watched over when a product is marketed on a worldwide basis, then the task becomes quite significant. And of course the "world does not stand still," new legislation comes regularly into force.

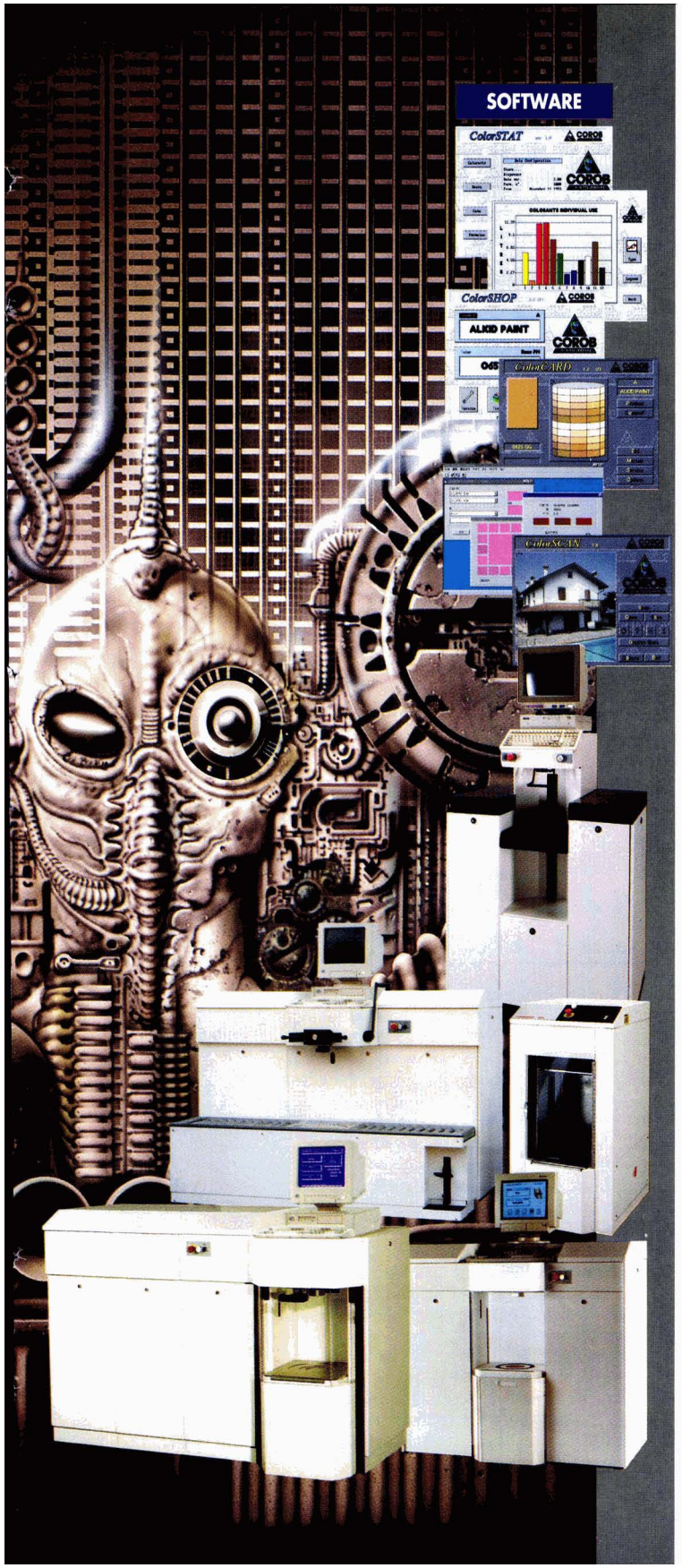
From the perspective of a major pigment producer, some of the different country requirements are looked at with respect to: placing a product on the market; labelling and material safety data sheet administration; gaining food contact approval; and impurity analysis.

Mattiello Memorial Lecture
Friday, October 25, 1996
10:30 a.m. - 11:30 a.m.
McCormick Place North—Room 230

Predicting In-Service Weatherability of Automotive Coatings: A New Approach

David R. Bauer, Ford Motor Co.

The prediction of long-term weatherability of coatings has always been a difficult task. This task has been made significantly more difficult by the recent, rapid changes in coating technology. Conventional weathering protocols which rely on observation of appearance changes after outdoor or laboratory exposures have not always been successful in anticipating in-service failures. This paper discusses the reasons for this, and describes a new approach for estimating in-service weatherability in coatings. The formalism begins by identifying specific failure modes and developing time-to-failure models which are based on fundamental studies of the chemistry and physics of failure. The statistical variation of the key material, process, and exposure parameters in the failure model are described in terms of distribution functions. Since photooxidation plays a critical role in most weathering issues, a specific distribution function for exposure harshness is estimated that can be used to describe the variation in photooxidation rate under actual in-service conditions. By combining a specific failure model with in-service variations in the key parameters, it is possible to estimate in-service failure rates as a function of material and processing variables, thus, allowing for improved risk assessment of any proposed material or processing change. The formalism also provides clearer direction in the design and use of specific laboratory and outdoor exposures in predicting performance. The method is illustrated by deriving distributions of time-to-failure based on two different hypothetical mechanisms of photo-induced coating delamination.



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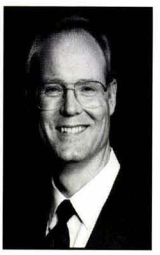
Annual Meeting Highlights

George R. Pilcher to Receive Heckel Award

George R. Pilcher, Technical Director, Coil and Extrusion Business Unit, for Akzo Nobel Coatings Inc., Columbus, OH, will be the recipient of the Federation's highest honor, the George Baugh Heckel Award, for 1996. Mr. Pilcher, a member of the CDIC Society, will receive the award at the Opening Session of the Annual Meeting on Wednesday, October 23.



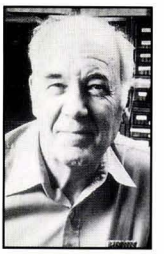
The Heckel Award recognizes the outstanding contributions that Mr. Pilcher has made to the Federation's interest and prestige while serving the organization in many capacities, which include being a member of the Publications, Mattiello Lecture, Roon, and Program Committees, a member of the JOURNAL OF COATINGS TECHNOLOGY Editorial Review Board, and serving as President of the Coatings Industry Education Foundation.

F. Louis Floyd Named Technical Focus Speaker

F. Louis Floyd, Vice President for Technology, of Duron Paints and Wallcovering, Baltimore, MD, will open the Federation's Annual Meeting Program as Technical Focus Speaker. The Technical Focus Speaker presentation honors on-going work in critical technical areas. Mr. Floyd's presentation entitled, "Pigment Flocculation is a Figment of Your Imagination," will be given on Wednesday, October 23, at 1:00 p.m.

Walter McCrone Presents Keynote Address

Renowned forensic scientist, Walter C. McCrone, will be the Keynote Speaker at the Opening Session of the FSCT's Annual Meeting. Mr. McCrone is Director Emeritus of the McCrone Research Institute, a non-profit corporation devoted to fundamental research in, and teaching of, microscopy and crystallography. In 1974, he, with his wife, Lucy, found the Vinland Map to be a 20th century fake, and, in 1980, he reported the Shroud of Turin to be a fine medieval painting. Mr. McCrone's presentation will focus on "Ten Thousand Dollar Per Square Centimeter Coatings."



Mattiello Lecture to be Given by David R. Bauer

Focusing on recent work in the area of prediction of coating service life, Dr. David R. Bauer, of Ford Research Laboratory, will present the Joseph J. Mattiello Memorial Lecture during the FSCT Annual Meeting. As Senior Staff Technical Specialist in the Manufacturing Systems Department of the Ford Research Labs, Dr. Bauer directs long-term research on paint application, characterization, and evaluation. Chosen from among those who have made outstanding contributions to science, Dr. Bauer will present the Mattiello Lecture on Friday, October 25 at 10:30 a.m. His presentation will be on "Predicting In-Service Weatherability of Automotive Coatings: A New Approach."

Bettina Gregory, of ABC News, to Speak at FSCT Luncheon

This year marks the 22nd year that Ms. Gregory has spent with ABC News. During these years, she has covered the White House, the Pentagon, Capitol Hill and the federal regulatory agencies as well as numerous presidential races and national political conventions. She has appeared on *World News Tonight with Peter Jennings, Good Morning America,* and both as a guest and a contributing correspondent to *Nightline* with Ted Koppel.

In 1994, she was named as ABC Radio's chief special events anchor. She anchored live gavel-to-gavel coverage of the entire O.J. Simpson murder trial for ABC Radio, where she also anchored live coverage of the 50th anniversary of the Normandy Invasion, and coverage of President Clinton's speeches and news conferences. She anchored live coverage of this year's Republican presidential primaries, and does a daily political wrap-up for the radio network. She regularly substitutes for Peter Jennings on his daily radio feature, *Peter Jennings Journal.*

Miss Gregory has also been a magazine reporter, contributing reports to *Lifetime Magazine,* produced by ABC News for the Lifetime cable channel. She has also written and narrated biographies for the show entitled *Biography* on the Arts and Entertainment cable channel. Her biography of First Lady Hillary Rodham Clinton won the ACE Cable Award as the Best Documentary of 1994.

Ms. Gregory has received numerous awards. One of her specials, "Flaws in the Shield: The Business of Defense," won the prestigious National Headliners Award for Outstanding Investigative Reporting by a TV network. *TV Guide* has also included Ms. Gregory in its lists of the top ten investigative reporters in television.

She covered the 1996 Summer Olympic Games for ABC Radio in Atlanta this past summer, and anchored ABC Radio's live coverage of both the 1996 Democratic and Republican national conventions. Ms. Gregory will be following the fall presidential campaign closely.

The FSCT Industry Luncheon is scheduled for Thursday, October 24, at noon in McCormick Place East. The Luncheon will also feature the presentation of FSCT awards. Luncheon tickets can be purchased on-site in Chicago at $30 each.

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Circle No. 123 on the Reader Service Card

Coatings Technology Conference

Executive Forum

Managing Technology for Strategic Success in the Coatings Industry

MONDAY EVENING (DINNER) & TUESDAY (WORKSHOP)
OCTOBER 21-22, 1996
CHICAGO HILTON AND TOWERS
8:00 A.M. TO 5:00 P.M. — ROOM—PDR 2

Course Description

This interactive, executive level workshop introduces the participants to the management tools and techniques required to fully link the R&D function with the strategic objective of the business. Based on the principles of "Third Generation R&D," the program uses presentations, group exercises and case studies. The course is designed for R & D group leaders; technical directors; senior chemists; marketing directors or managers; sales directors or managers; small business owners; and anyone with strategic leadership responsibility in their organization.

Attendees will learn:

- Methods to determine the feasibility of new technology
- How to assess the validity of new concepts and ideas
- Ways to use time and money more wisely in the pursuit of new advances in technology
- How to better understand the impact of R&D on the bottom line
- Techniques to associate marketing and technology while pursuing new ideas

Registration limited to 30 attendees

Instructors

- John Martin (Arthur D. Little)
- Eric Carlson (Arthur D. Little)
- Stephen Rudolph (Arthur D. Little)

Pre-Convention Training Seminar

Faster to Market with Better Products through Design of Experiments

TUESDAY, OCTOBER 22, 1996
CHICAGO HILTON AND TOWERS
8:00 A.M. TO 4:45 P.M. — ROOM—CONTINENTAL "B"

Seminar Description

Design of Experiments (DOE) will give the coatings technologist five important benefits: cutting the time from inception to market; increasing product quality; lower raw material costs; research and development productivity; and manufacturable products. The understanding of DOE will allow the attendee to make a greater contribution to his or her company. The course is targeted at laboratory and R&D personnel and project managers and technicians interested in becoming more effective in the R&D function.

Attendees will learn:

- Better planning and project management
- How to better allocate resources through the use of time saving methods
- Techniques to achieve greater certainty of results
- Ways to focus efforts to predict coatings properties
- Methods to develop truer selection criteria/ evaluation
- The purpose of various testing procedures and how to know when to use them, and when not to use them
- The importance of not reaching conclusions before experiments

Instructor

- Charles Rooney (Orr & Boss)

Pre-Convention Training Seminar

WORKSHOP
Effective Technical & Scientific Writing

TUESDAY, OCTOBER 22, 1996
CHICAGO HILTON AND TOWERS
9:00 A.M. TO 4:00 P.M. — ROOM—JOLIET

Seminar Description

For all levels of laboratory and R&D personnel along with applicators and anyone with responsibility for writing memos, letters, reports, manuals, specifications and proposals on a routine basis. The session includes in-class writing exercises designed for practical application, and allows time for individual attention. Participants are invited to submit writing samples in advance for a confidential review by the instructor.

Attendees will learn:

- Skills and techniques to improve technical communication
- How to improve effectiveness in communicating technological issues
- Methods of data collection and tabulation to maximize impact of data on the presentation
- Proven techniques to make technical issues understandable
- How to translate technical terms for non-technical readers
- How to improve writing skills: structure and format
- Ways to "rethink how you write"
- How to write the first draft of a document
- Approaches to use when writing for another person
- Editing techniques and a review of punctuation and usage

Instructor

- Salvatore J. Iacone (Consultant)

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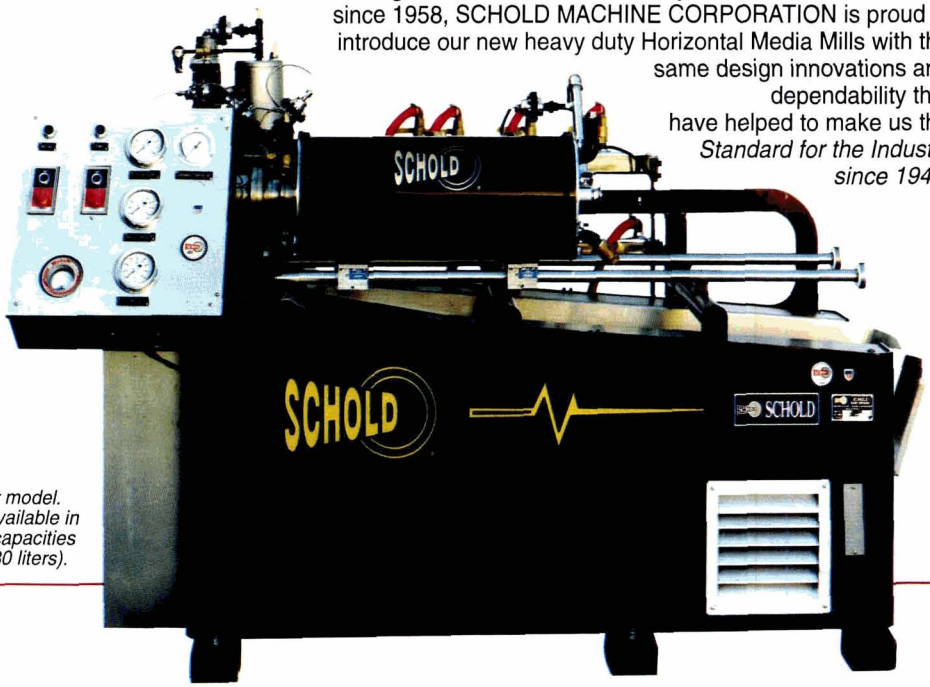

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Pre-Convention Training Seminar

Surfactant Chemistry

TUESDAY, OCTOBER 22, 1996
CHICAGO HILTON AND TOWERS
8:30 A.M. TO 4:45 P.M. — ROOM—CONTINENTAL "A"

Seminar Description

For R&D personnel, synthesizers, formulators and applicators in the coatings and ink industries, this course provides a better understanding of surfactants and polymers, new technologies and uses in this area, a working knowledge of surfactant synergy in waterborne technology, details on coatings and flows, and information on defoamers.

Seminar Topics and Instructors

- "Introduction: Coatings and Flows"—Skip Scriven, University of Minnesota
- "General Surfactant Properties"—Steve Snow, Dow Corning
- "Surfactant Effects on Wetting and Dynamic Surface Tension"—Bob Stevens, Air Products and Chemicals
- "Surface Tension, Coatings Defects and Substrate Wetting"—Joel Schwartz, Air Products and Chemicals
- "Pigment Surface Wetting, Dispersion Stabilization and Defoaming"—Ed Orr, BYK Chemie

Pre-Convention Training Seminar

Winning Technical Presentations

TUESDAY, OCTOBER 22, 1996
CHICAGO HILTON AND TOWERS
8:30 A.M. TO 4:30 P.M. — ROOM—MARQUETTE

Seminar Description

For laboratory and R&D personnel at all levels, marketing and sales staff, and anyone responsible for delivering technical presentations. Attendees will learn how to develop effective visuals; proper speaking techniques and data organization; how to handle question and answer sessions; tips on transferring written information to speaking terms; and how to communicate clearly to all audiences. This program combines lecture, interaction and small group projects.

Attendees will learn:

- How to effectively develop visuals for technical presentations
- Proper speaking techniques
- How to organize data
- Tips to transfer written information for a speech
- How to handle question and answer sessions
- Presentation style and format
- How to effectively communicate to all audiences
- The ability to aim presentations to any size audience, from one to hundreds

Instructor

- Carter Johnson (Buying Time Seminars)

Registration limited to 25 attendees

Pre-Convention Training Seminar

Coatings Spray Applications

TUESDAY, OCTOBER 22, 1996
BINKS MANUFACTURING CO., FRANKLIN PARK, IL
(Transportation Provided—Bus will depart from the Chicago Hilton and Towers at 7:30 a.m.)

Seminar Description

Provides both experienced and novice applicators, field service personnel, specifiers and formulators with information on current and upcoming technologies as they apply to the application of coatings and finishes. Considered as a Learning Exchange Seminar, attendees will learn how to properly select, maintain and operate spray finishing equipment and to answer a variety of questions related to spray finishing.

Seminar Topics

- "Spray Applications"
- "HVLP: High Volume, Low Pressure"
- "Spray Gun Service"
- "Electrostatics: Liquid and Powder"
- "Personal Protection/Spray Booths"
- "Hands on Spraying: Air Spray, HVLP, Air/Airless"

Instructor

- Jerry Hund, Binks Manufacturing

Attendance is limited.

Technology Conference Course

Advances in Coatings Characterization

WEDNESDAY - THURSDAY, OCTOBER 23-24, 1996
MCCORMICK PLACE NORTH
8:15 A.M. TO 5:00 P.M. — ROOM—227

Course Description

Provides a quick review of key analytical techniques in the coatings industry, along with an update on recent methods. Attendees will also see examples of successful application of these techniques to solve practical paint and coatings problems. This course is targeted towards laboratory directors, QC managers, customers/specifiers, graphic arts industry personnel and analytical personnel.

Course Topics and Instructors

- "Optical and Electron Microscopy Analysis of Coatings"—Skip Palenik, MicroTrace Associates
- "Elemental and Molecular Characterization of Coating Surfaces"—Paula Clark, Air Products and Chemicals
- "Infrared/Raman Spectroscopy of Coatings"—Marek Urban, North Dakota State University
- "Three-Dimensional Coating Topography Analysis"—Andrew Gilicinski, Air Products and Chemicals
- "Particle Size Analysis of Latex Systems"—Ted Provder, ICI Glidden Paints
- "Thermal Analysis of Coatings and Polymers"—Mike Neag, ICI Glidden Paints
- "Rheology of Coatings and Polymers"—Richard Eley, ICI Glidden Paints

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- "Mechanical Properties of Polymers and Coatings"—Loren Hill, Monsanto Corp.
- "EIS Instrumentation and Methodologies"—Richard Granata, Lehigh University
- "Application of Electrochemical Impedance to Problem Solving in the Coatings Industry"—Peter Kamarchik, PPG Industries
- Vendor Demonstrations

TECHNOLOGY CONFERENCE COURSE

Substrates and Coatings

WEDNESDAY - THURSDAY, OCTOBER 23-24, 1996
MCCORMICK PLACE NORTH
8:30 A.M. TO 4:30 P.M. — ROOM—226

Course Description

Provides attendees with a better understanding of the effects substrates have on coatings performance. Attendees will learn of the various considerations to examine in order to develop the right coating for the right substrate. This course is aimed at formulators, laboratory and R&D chemists, technical service and sales personnel, along with coatings specifiers.

Course Topics and Instructors

- "Painting ABS Plastics"—Bruce Thill, Dow Chemical
- "Coatings on Plastics"—James D. McGuiness, Red Spot Paint and Varnish
- "Wood Coatings and Substrates: Wood Properties and Their Effect on Finish Performance"—Sam Williams and Mark Knaebe, USDA Forest Products Lab
- "Metal Substrates"—Doug Grossman, Q Panel
- "Coatings for Metals"—Simon Boocock, SSPC
- "Concrete as a Paintable Surface"—Eric S. Kline, KTA-Tator
- "Coatings for Concrete"—Dave Hazlett, Tnemec

Technology Conference Course

Polymer Chemistry for the Coatings Formulator

WEDNESDAY - THURSDAY, OCTOBER 23-24, 1996
MCCORMICK PLACE NORTH
8:30 A.M. TO 4:15 P.M. — ROOM—229

Course Description

This course, developed by the FSCT Professional Development Committee, provides current information on polymer chemistry for coatings formulators, R&D chemists, and sales and marketing personnel with strong technical backgrounds or interests. Attendees will realize a greater understanding of the essential concepts of polymer science and the underlying principles to determine coatings using scientific principles as opposed to trial and error and is also relevant for ink, sealant and adhesive industry personnel.

Course Topics and Instructors:

- "Polymer Fundamentals"—Frank Jones, Eastern Michigan University
- "Condensation Polymerization"—Fritz Walker, Air Products and Chemicals
- "Chain Growth Polymerization"—J. David Nordstrom, DuPont Automotive
- "Introduction to Emulsion Polymerization"—Alvin C. Lavoie, Rohm and Haas Co.
- "Vinyl Latexes for Coatings"—Jennifer Cogar, McWhorter Technologies
- "Acrylics"—Patricia Lesko, Rohm and Haas Co.
- "Alkyds and Polyesters: Versatile Condensation Polymers"—Paul R. Baukema, Akzo Nobel Coatings, Inc.
- "Chemistry and Technology of Polyurethane Coatings"—Terry Potter, Bayer Corp.
- "Rheological and Mechanical Properties of Coatings"—Manoj Gupta, BASF Corp.
- "Epoxy Resins and Curing Agents"—David A. Dubowik, Air Products and Chemicals
- "Melamine Crosslinking Agents for Surface Coatings"—Nicholas Albrecht, Cytec Industries, Inc.
- "Modern Analytical Techniques for Polymer Characterization"—Bill Simonsick, DuPont Marshall Labs
- Problem Solving/Round Table Discussions

Technology Conference Course

"Back to Basics": General Overview of Coatings Technology

WEDNESDAY - THURSDAY, OCTOBER 23-24, 1996
MCCORMICK PLACE NORTH
9:00 A.M. TO 4:30 P.M. — ROOM—228

Course Description

For chemists new to the industry or with minimal experience, lab technicians, and sales, marketing and field support personnel. The program will provide attendees with an overview of coatings types; a review of basic coatings composition; and cost savings ideas for formulation. This program was originally presented as the East Coast Training Conference by the Philadelphia Society for Coatings Technology.

Course Topics and Instructors:

- "Introduction to Paints and Coatings"—Donald Denny, E.W. Kaufmann
- "Oils, Varnishes and Alkyds"—Bruce Johnson, Engineered Polymer Solutions
- "Resins: Solvent-OEM Industrial"—Donald Fritz, Retired
- "Water-Reducible Resins: An Overview"—Jeff Danneman, Reichhold Chemical
- "Resins: Emulsion, Architectural and Industrial"—Robert J. Klein, Air Products and Chemicals
- "Wetting Agents, Defoamers, Dispersants, and Thickeners"—Sam Morell, S.P. Morell and Company
- "Additives II"—Tim Savage, Troy Chemical
- "Introduction to the Use of Pigments in Coatings"—Tom Brown, Consultants Consortium
- "Color Pigments: Price Versus Performance"—Jim Delaney, Ciba-Geigy Pigments
- "Basic Paint Formula Calculations"—George Schmitz, S.P. Morell and Company
- "Paint Testing"—Saul Spindel, D/L Laboratories
- "Paint Application: Industrial and Architectural"—William Fabiny, Sermagard Coatings

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Registration Fees

Training taken to maintain or improve your professional skills is usually tax deductible as an ordinary and necessary business expense. Consult with your tax advisor for applicability.

FSCT's refund policy: *Cancellations for advanced registrations received on or before October 9 will be charged $15. Cancellations received after that date will be charged $50. No refunds will be issued for cancellations received after October 16. All refunds will be processed after November 1.*

ALL REGISTRATIONS INCLUDE THE EXPO!

Registration Package—On-Site Pricing	Member	Non-Member
ICE Expo and FSCT Annual Meeting Presentations	**$90**	**$125**
One-Day (Wednesday & Thursday)	$70	$90
One-Day (Friday)	$40	$50
Full Technology Conference & Expo	**$545**	**$645**
Coatings Technology Conference Two-Day Course	$445	$545
Executive Forum	**$445**	**$345**
Pre-Convention Training Seminars	$245	$295
Social Guest Program	**$70**	**$70**
Retired FSCT Member and Spouse (each)	$30	—
Student (valid student ID requried)	**$15**	**$15**

Shuttle Service

Shuttle service between the official ICE hotels and the McCormick Place North will be offered according to the below schedule.

Key to Chicago Map

1. **Chicago Hilton and Towers**
2. **Clarion Executive Plaza Hotel**
3. **Essex Inn**
4. **Fairmont Hotel - At Illinois Center**
5. **Hyatt on Printers Row**
6. **Hyatt Regency Chicago**
7. **Palmer House Hilton**
8. **Renaissance Chicago**

Schedule for Routes

Tuesday, October 22 ..... 7:30 a.m. – 5:00 p.m.
Wednesday, October 23 ..... 7:30 a.m. – 6:00 p.m.
Thursday, October 24 ..... 7:30 a.m. – 6:00 p.m.
Friday, October 25 ..... 7:30 a.m. – 3:00 p.m.

Routes indicate the hotels served and shuttle stop locations.

South Route

Hotel Served	Location of Shuttle Stop
Palmer House Hotel	Wabash St. entrance of hotel
Chicago Hilton and Towers	8th St. entrance of hotel
Essex Inn on Grant Park	Shares Chicago Hilton and Towers stop
Hyatt on Printers Row	Hotel entrance by Deerborne St.

River Route

Hotels Served	Location of Shuttle Stop
Executive Plaza Hotel	Wacker Dr., main entrance to hotel
Renaissance Chicago	Shares Executive Plaza Hotel stop
Hyatt Regency Chicago	East Tower entrance of hotel on Wacker Dr.
Fairmont Hotel	Shares Hyatt Regency stop

Registration Hours

McCormick Place North
- Tuesday, October 22 ..... 7:30 a.m. - 5:00 p.m.
- Wednesday, October 23 ..... 7:30 a.m. - 5:00 p.m.†
- Thursday, October 24 ..... 7:30 a.m. - 5:00 p.m.†
- Fri., Oct. 25 ..... 7:30 a.m. - 12 Noon

Chicago Hilton and Towers
- Monday, October 21 ..... 5:00 p.m. - 7:00 p.m.†*
- Tuesday, October 22 ..... 7:30 a.m. - 5:00 p.m.†*
- Wednesday, October 23 ..... 7:30 a.m. - 10:00 a.m.*

Hyatt Regency Chicago
- Tuesday, October 22 ..... 7:30 a.m. - 5:00 p.m.*
- Wednesday, October 23 ..... 7:30 a.m. - 10:00 a.m.*

Expo Hours

Wednesday, October 23 ..... 10:00 a.m. - 5:00 p.m.
Thursday, October 24 ..... 9:00 a.m. - 5:00 p.m.
Friday, October 25 ..... 9:00 a.m. - 12 Noon

†Conference registration.
*Verification/badge holder distribution for advance registration.

NPCA Annual Meeting

The National Paint and Coatings Association will hold its annual meeting on Wednesday and Thursday, October 23-24, at the Palmer House in Chicago.

NPCA will admit registered attendees of the FSCT International Coatings Expo to the Forum Sessions being held during its annual meeting at no additional charge. The Forum Sessions will be held at the Palmer House on October 23 and October 24.

Ground Transportation

From O'Hare International Airport: Shuttle bus service is available via Continental's Airport Express; fare is $14.75 one way. Taxi fares run upwards of $25 to the downtown hotels. The Chicago Transit Authority (CTA) operates rail service from O'Hare to downtown Chicago for $1.25 one way.

From Midway Airport: Shuttle bus service is available via Continental's Airport Express; fare is $10.75 one way. Taxi fares run upwards of $18 to the downtown hotels.

Social Guest Program

Activities for Social Guest registrants begin on Wednesday afternoon with a Welcome Social* at the Chicago Hilton and Towers Hotel.

On Thursday, Social Guests enjoy a continental breakfast and afterwards depart on motorcoaches for a tour of Chicago's downtown area. A visit to the Art Institute of Chicago will be included in the tour. Participants will view the traveling exhibition of the works of Edgar Degas. Organized by the National Gallery in London and the Art Institute of Chicago, the exhibit features his later works between 1886, when he participated in the last impressionists exhibit and 1918, the year of his death.

An alternate choice to the Art Institute is Navy Pier, offering attendees a visit to the IMAX Thearter.

An exclusive luncheon for Social Guests will be included in the tour.

The fee for Social Guests of $60 in advance and $70 on-site includes the Social Guests activities, three days admittance to the Expo, and attendance to the Opening Session. Space is limited and pre-registration is strongly suggested.

**Sponsored in part by Air Products & Chemicals*

(The category Social Guest is not to be used by co-workers or associates in the industry. It applies to the Spouse or Significant Other of the industry attendee.)

Federation Meetings and Events

Monday, October 21

Past-Presidents' Reception (6:30 p.m.) ..... Chicago Hilton, PDR #4
Past-Presidents' Dinner (7:30 p.m.) ..... Chicago Hilton, PDR #1
Past-Presidents' Spouses' Dinner (7:30 p.m.) ..... Chicago Hilton, PDR #3

Tuesday, October 22

Board of Directors' Meeting (9:00 a.m.) ..... Chicago Hilton, Waldorf Room
ICE Exhibitors' Reception (6:00 p.m.) ..... Chicago Hilton, Boulevard Room

Wednesday, October 23

Opening Session (8:00 a.m.) ..... McCormick Place East, E450
ICE Opens (10:00 a.m.) ..... McCormick Place North, Upper Hall
CIEF Educators' Luncheon (11:30) ..... McCormick Place North, N130
CSI Luncheon Meeting (11:00) ..... McCormick Place North, N126
Social Guest Welcome Reception (2:00 p.m.) ..... Chicago Hilton, Continental Ballroom

Thursday, October 24

Social Guest Continental Breakfast (7:30 a.m.) ..... Chicago Hilton, Continental Ballroom
Social Guest Tour and Luncheon (8:45 a.m.) ..... Departs Continental Ballroom Returns to McCormick Place North by 2:45
FSCT Industry Luncheon (12 Noon) ..... McCormick Place East, E451
International Visitors' Reception (6:30 p.m.) ..... Chicago Hilton, Waldorf Room

Friday, October 25

Annual Business Meeting (9:00 a.m.) ..... McCormick Place North, N226
President's Reception (6:30 p.m.) ..... Chicago Hilton, Marquette Room

Chicago

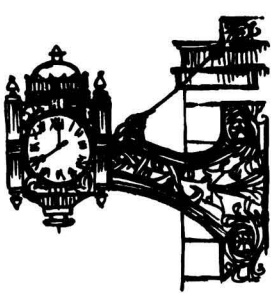
The best way to get to know any city is to walk its streets, listen to its citizens, browse through stores, and try native foods. Chicago is no exception. You'll find a wealth of ethnic museums, designated Chicago Landmark Neighborhoods and cuisine from around the world tucked away in distinctive communities that make Chicago the cosmopolitan city it is. Whether you choose to see our "city of neighborhoods" on foot or by sightseeing bus or boat, you'll get a special perspective on Chicago.

Hyde Park/Beverly/Pullman Historic Neighborhood

Hyde Park is the home of the University of Chicago and its Oriental Institute (museum of ancient Near Eastern civilization), the Museum of Science and Industry, and the DuSable Museum of African American History. Further south are architecturally significant Beverly and Pullman, an 1880s planned community for employees of the sleeping-car firm.

Near South Side/ Chinatown

You'll want to visit the Illinois Institute of Technology and its Mies van der Rohe buildings and, for dramatic contrast, the Prairie Avenue Historic District with its landmark Glessner House and the Widow Clarke House, the oldest building in Chicago. See a White Sox game in nearby Comisky Park. Then on to Chinatown for shopping, browsing, and four-star restaurants. It's family fun, day or evening, and only minutes from downtown.



The Loop/Downtown

When it comes to open-air sculptures, Chicago's No. 1. Visit the Chicago Architectural Foundation for maps and information on architectural tours. The Loop/ Downtown area has it all: world-class shopping on State Street, The Art Institute of Chicago, the Museum of Broadcast Communications, the Harold Washington Library Center, the Symphony and Lyric Opera, theatres, and our financial district. A stroller's/ shopper's paradise featuring the flagship stores of both Marshall Field's and Carson Pirie Scott.

River North

This gentrified neighborhood is just north of the Merchandise Mart and west of Michigan Avenue. Rehabbed loft buildings house art galleries, auction houses, antique dealers, jewelers, and clothing boutiques. Many of the hottest new restaurants and clubs can be found on West Ontario and other side streets.

North Michigan Avenue/ Streeterville

Michigan Avenue, stretching north from the river to Oak Street, is truly a Magnificent Mile, our retail rival to Rodeo Drive! Take time to explore North Pier Festival Market, restaurants, and the Chicago Children's Museum, Rush Street nightlife, the Terra Museum of American Art, and Museum of Contemporary Art...the most sophisticated neighborhood in town.

Near West/Southwest Side

A gourmet's destination, regardless of your preference. Choose from the Hispanic community of Pilsen (visit the Mexican Museum of Fine Arts), Greektown, or Little Italy. The University of Illinois-Chicago campus (site of Jane Addams' Hull-House) and West Side medical centers are also located here.

Printer's Row/ Burnham Park

A must-see for architecture buffs. Restored buildings, jazz and blues clubs, great bookstores, restaurants, and galleries abound in the "new neighborhood" just south of the Loop. Take time to tour the landmark Auditorium Theatre, Spertus Museum of Judaica, Columbia College's photography gallery—all on South Michigan Avenue facing Grant Park. Also be sure to visit the Shedd Aquarium, Field Museum of Natural History, and The Adler Planetarium.

Little Village

The heart of the Mexican community in the Midwest welcomes you. Experience the sights and sounds of "Little Mexico," located around the area of 26th Street and Kedzie, where you will find imported goods, specialty items, and, of course, the best Mexican cuisine in the Midwest.

Heart of Italy

The Heart of Italy, minutes west of Chicago's Loop, is where traditional Italian cuisine is served at its best. One of the oldest and most unique neighborhoods in the city, it consists mostly of Italians from the Tuscany region. All of the restaurants are family-owned and operated—you are guaranteed a meal just like mama used to cook. Located just 10 minutes southwest of the Loop, it is a perfect location for McCormick Place, Soldier Field, and Chicago Stadium traffic.

Old Town

Best known as home of the Second City improvisational group, Old Town boasts one of the best and oldest summer art fairs in America. You'll find great shopping and restaurants along Wells Street. Explore the side streets for architectural gems and visit the Chicago Historical Society, just west of Lincoln Park.

Lincoln Park/Lincoln Park West/Lakeview

You'll find shops, restaurants, live entertainment and nightclubs clustered along Clark Street and Lincoln Avenue, not to mention Wrigley Field, home of the Chicago Cubs. Old-time German restaurants coexist with memorabilia-filled sports eateries. Enjoy the Lincoln Park Zoo, the Conservatory, and the Chicago Academy of Sciences.

DePaul/Halsted Street/ Clybourn Avenue

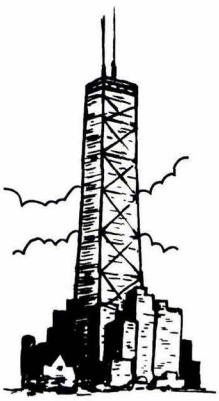
Halsted is one of the hottest entertainment/dining streets in the country. You'll find top blues clubs—plus Chicago's "Off Loop" theatre district. Visit the DePaul University neighborhood, explore the Clybourn Avenue "corridor," packed with restaurants, trendy shops, and spectacular nightlife.

Bucktown/Wicker Park

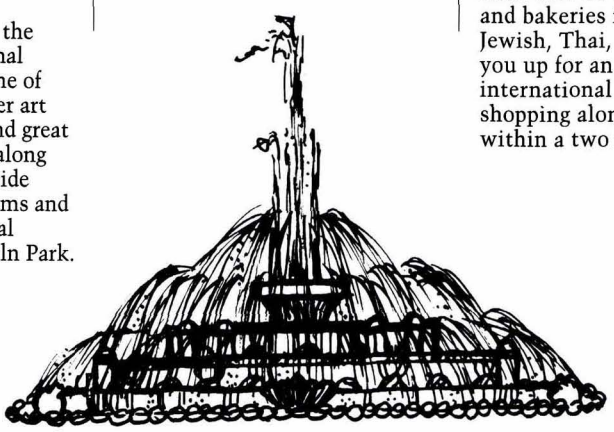
If you loved San Francisco's North Beach in the '60s, you're going to feel right at home in Chicago's hottest new neighborhood. From performance art, poetry readings, and jazz clubs to cutting edge art galleries and a wealth of restaurants and coffee houses, Bucktown and Wicker Park are the most contemporary parts of town—and they're just west of the Clybourn/Halsted restaurant and entertainment centers.

Argyle Street/ Andersonville/Rogers Park/ Devon-North Town

You'll find Asian cuisine and shops in the Argyle/North Clark



Street which has a pagoda atop its "L" station and a fine array of Chinese/ethnic restaurants, gift/grocery stores, and fresh bakeries. Farther north on Clark is Andersonville, with stores, bakeries, and restaurants featuring Scandinavian crafts and food (plus the Swedish-American Museum). The Devon-North Town area, at the far north end of the city, is Chicago's own International Marketplace. Stepping into the busy thoroughfare between 2300 and 2900 W. Devoe is like walking into an exotic bazaar. The heady scents and tastes of cooking from over 60 ethnic restaurants and bakeries including Indian, Jewish, Thai, and Assyrian gear you up for an endless variety of international and discount shopping along the avenue within a two mile radius.



Meet our new team members

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DEFOAMER

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Waterpoxy® 801
Curing Agent

NAME:

DSX®-3000
rheology modifier

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curing agent

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dispersant

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The new "Paint Show"

Exhibitors

(As of 9/17/96)

World's Premier Coatings Expo Features Over 300 Exhibits

The largest coatings-related exhibition in the world—the FSCT International Coatings Expo—will be held in conjunction with the FSCT Annual Meeting and Coatings Technology Conference at McCormick Place North. Over 320 supplier companies to the coatings manufacturing industry will be present to discuss their newest products and services. In over 97,000 sq. ft. of exhibits will be displayed a wide variety of raw materials, production equipment, containers and filling equipment, laboratory apparatus, and testing and application devices for the paint and coatings producer.

Key personnel from the top technical sales staff of supplier companies will be available to provide attendees with an opportunity to learn of the latest developments in their products and services.

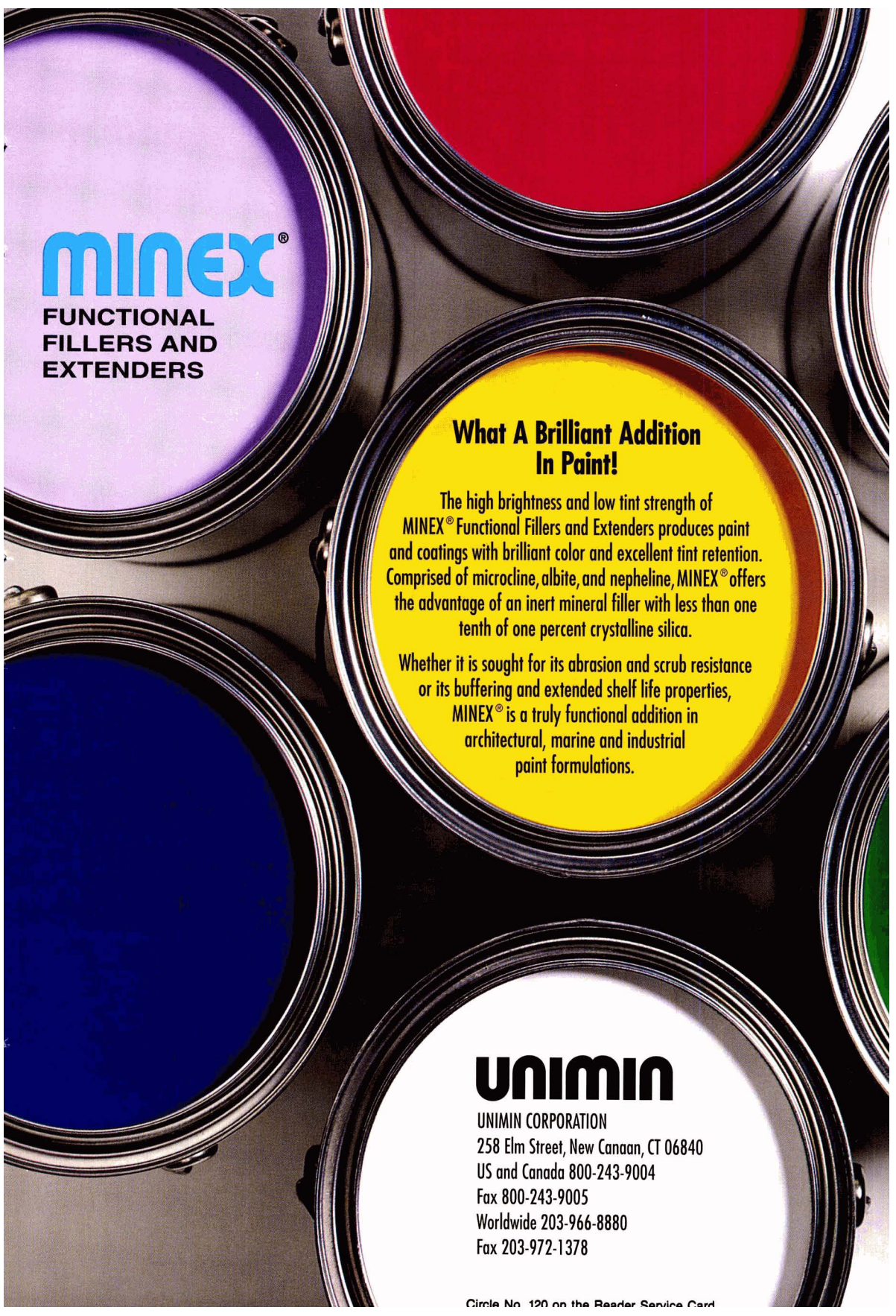
List of Exhibitors with Booth Numbers

A.P. Dataweigh Systems 1947
Aceto Corp. 507
ACT Laboratories, Inc. 1342
Adhesives Age 2543
Advanced Software Designs 725
Air Products & Chemicals, Inc. 1505
Akzo Nobel Chemicals & Akzo Nobel Resins 840
Alar Engineering Corp. 2439
Alcan-Toyo America, Inc. 1818
AlliedSignal Specialty Chemicals 2816
Alnor Oil Co. 1440
Ambrose Co. 2825
ACS Information & Services 102
American Colors, Inc. 1839
American Paint & Coatings Journal 2836
Amoco Chemicals 2225
ANGUS Chemical Co. 1023
Anker Labelers USA Inc. 200
Aqualon 1842
Araki Iron Works Co., Ltd. 2823
Arco Chemical Co. 1826
Arizona Instrument Corp. 1144
Arizona Oxides 115
Ashland Chemical Co. Industrial Chemicals & Solvents Div. 1626
Atlas Electric Devices 2023
Atotech USA Inc. 1751
Aztec Peroxides Inc. 2341

B.A.G. Corp. 100
BASF Corp. 818
BatchMaster Software Corp. 2607
Bayer Corp. 1623
Bergen Barrel & Drum Co. 2639
Blacoh Fluid Control, Inc. 2718
Borden Chemical, Inc. 2804
Bowers Process Equipment Inc. 540
British Standards Institution, Inc. 2802
Brookfield Engineering Laboratories, Inc. 2044
Buckman Laboratories, Inc. 1611
Buhler, Inc. 1238
Bulkcon Systems International USA Ltd 2041
Burgess Pigment Co. 1537
BYK-Chemie USA 2018
BYK-Gardner, Inc. 2014

C.I.P. Products/Sellers Cleaning Systems 112
Cabot Corp., CAB-O-Sil & Special Blacks Divs. 508
Calgon Corp. 1820
Cardolite Corp. 1147
CB Mills 1031
CB Environmental 137
CCP 419
CEM Corp. 239
Center for Applied Engineering Inc. 736
Chemical & Engineering News 103
Chemical Manufacturers Association 107
Chemical Marketing Reporter 2803
Chemical Week 2326
Chemicals Incorporated 1951
Chemir/Polytech Laboratories, Inc. 340
Ciba Additives, Pigments, & Polymers Divs. 1211
Cimbar Performance Minerals 104
Civacon 339
Clariant Corp. 406
Clawson Container Co. 641
CMI International 2818
Coatings Magazine 443
Coatings World/Ink World 1044
Color Corp. 2420
Color Instruments, Inc. 2721
ColorTec Associates, Inc. 2606
Columbian Chemicals Co. 1938
Composite Particles, Inc. 749
Consolidated Research 1731
Container Management Services, Inc. 123
Corrosion Control Consultants & Labs 405
Cortec Corp. 2723
CR Minerals Corp. 1448
Crosfield Coo. 435

Bold indicates Expo sponsors.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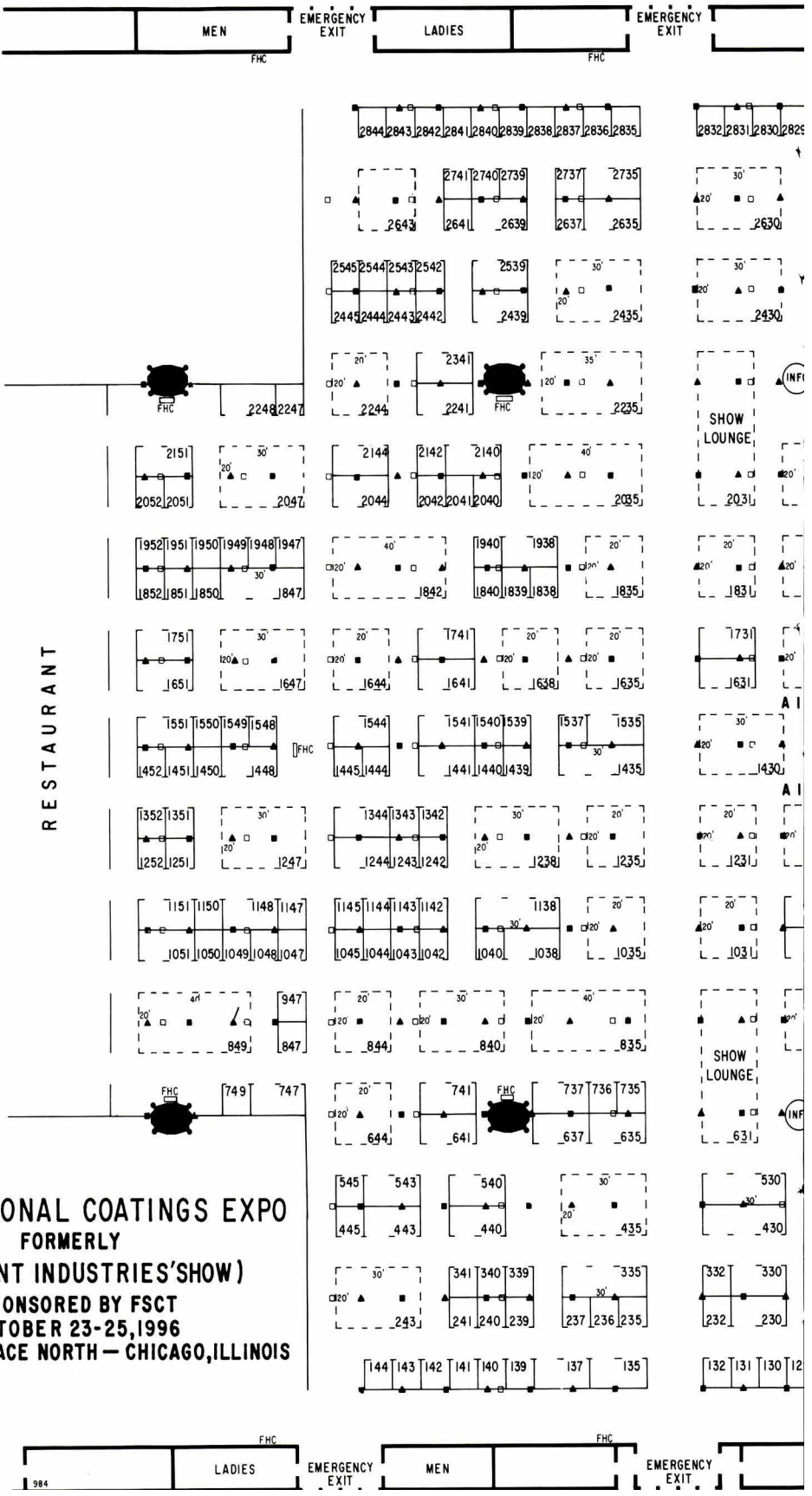
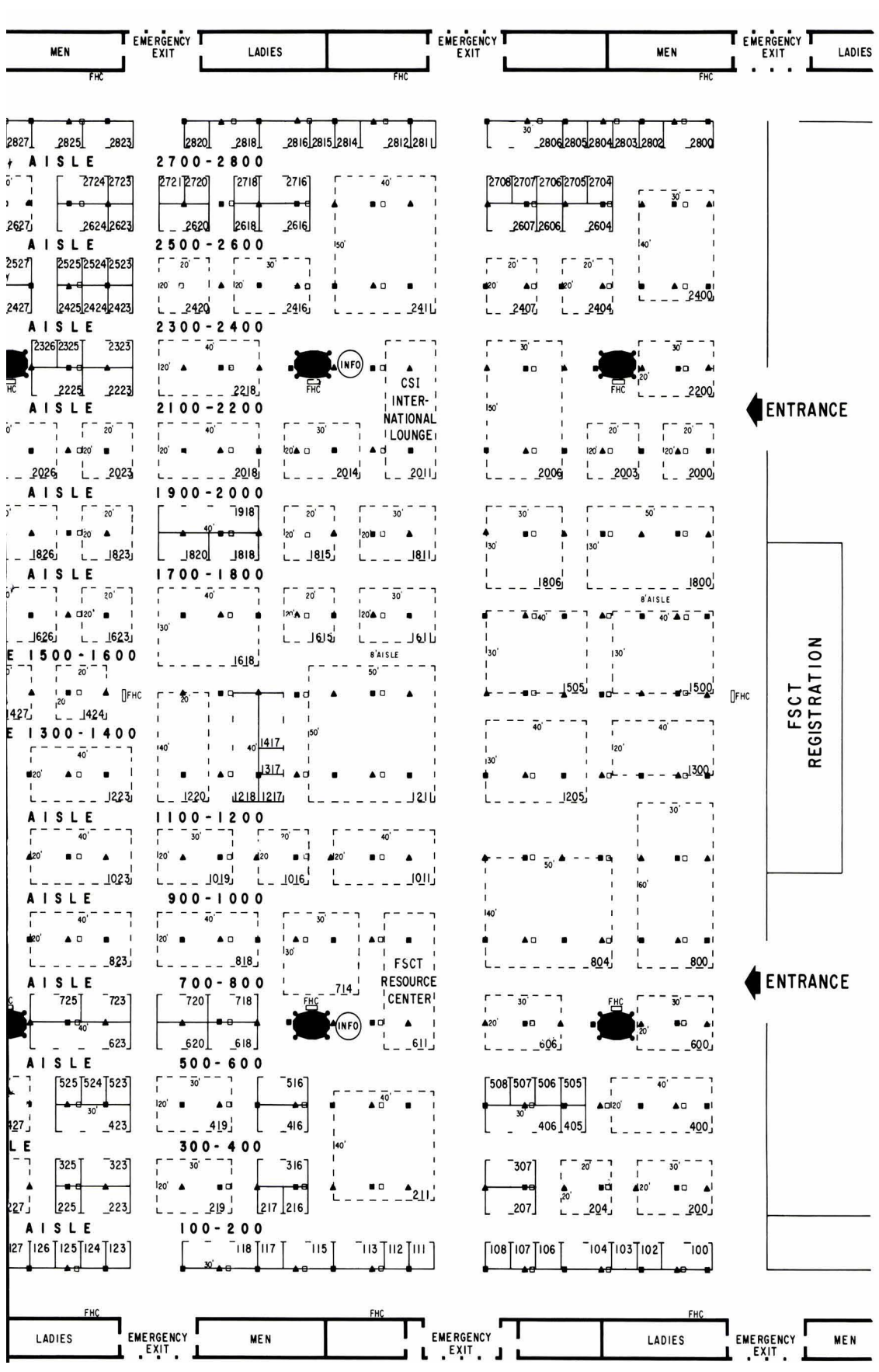

MEN
EMERGENCY EXIT
LADIES
EMERGENCY EXIT
FHC
RESTAURANT
SHOW LOUNGE
SHOW LOUNGE
INTERNATIONAL COATINGS EXPO
FORMERLY
(THE PAINT INDUSTRIES'SHOW)
SPONSORED BY FSCT
OCTOBER 23-25,1996
McCORMICK PLACE NORTH — CHICAGO,ILLINOIS
LADIES
EMERGENCY EXIT
MEN
EMERGENCY EXIT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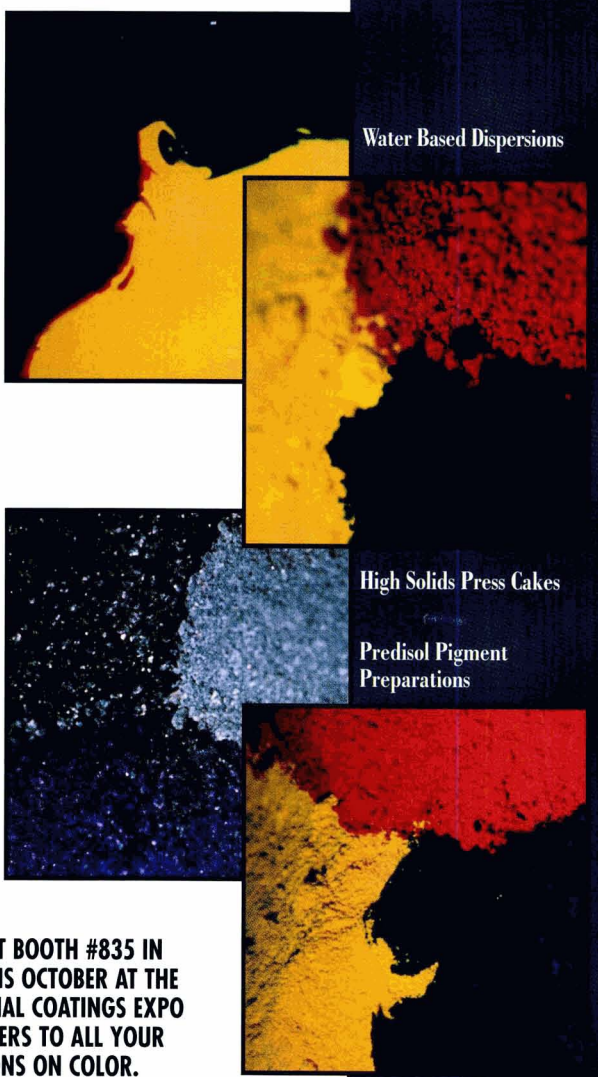
The Physics of Color. . .

Colored pigments manufactured include azo reds and yellows, phthalocyanine blues and greens, quinacridone reds, violets and magenta, in addition to carbazole violet. The products are each available from one or several of the Colors Group's worldwide facilities to ensure stability of supply in all circumstances.

Our pigments are available in every conceivable physical form to fulfill all the needs of the consuming industries. Such forms include dry toner, water based dispersion, high solids press cakes, and pigment preparations such as PREDISOL pigment dispersions for powder coatings.



Water Based Dispersions

High Solids Press Cakes

Predisol Pigment Preparations

Dry Toner

VISIT US AT BOOTH #835 IN CHICAGO THIS OCTOBER AT THE INTERNATIONAL COATINGS EXPO FOR ANSWERS TO ALL YOUR QUESTIONS ON COLOR.

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Sun Chemical Corporation
Colors Group
5020 Spring Grove Avenue
Cincinnati, OH 45232
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Fax: 513-632-1537
Fax: 513-681-3778

Begins with Sun's Chemistry.

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Exhibitors

Listed by Product/Services Classification

This listing, followed by booth number, was compiled from information provided by the exhibitors.

Raw Materials

Additives

Chemical Intermediates

Colorants

Introducing a New Way to a Great Finish: Exx-RD™ Reactive Diluent.

Traditionally, the race for reduced VOCs using reactive diluents has resulted in compromises in performance, like reduced hardness, flexibility or durability. No longer.

Lower VOCs Without Sacrificing Performance

Exxon Chemical has just broken that tradition with the development of Exx-RD Reactive Diluent. This unique, leading edge reactive diluent technology is designed to provide reduced VOCs for both existing and emerging ultra-high solids coatings formulations, without compromising performance! In fact, film performance is often improved in areas of hardness, flexibility, chip resistance, and chemical resistance.

Attractive in Many Applications

The combination of reduced VOCs and increased performance makes Exx-RD Reactive Diluent effective for a variety of coatings applications including:

- automotive
- general industrial
- coil and metal office furniture

New Exx-RD Reactive Diluent is setting the pace for VOC reduction plus performance, and is available now from Exxon Chemical. For information about how Exx-RD Reactive Diluent can help improve your finish, and for complimentary samples, contact Vijay Swarup or Rich Ryan at our coatings lab in Baytown, Texas. Call 800-361-7961 for Exx-RD Reactive Diluent: *A Solution Without Compromise.*

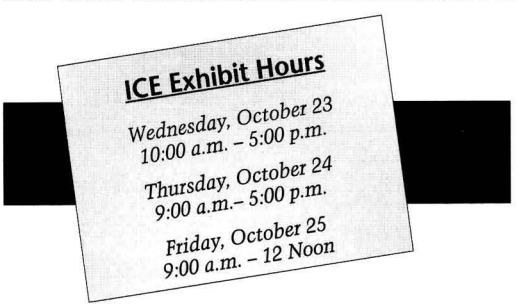
EXXON CHEMICAL

Extenders

Fibers

Initiators

Latices and Emulsions



Monomers

Oils (Drying/Non-Drying)

Pigments, Inorganic

Pigments, Organic

Pigments, Metallic

Plasticizers

Resins

Solvents

Waxes

Production/Application Equipment

Application Equipment/Processes

Cleaning

Containers/Drums

Curing Systems

Dispensing

Filling/Packaging/Labeling

Filtering/Straining

Grinding/Milling

Instrumentation & Control

Materials Handling/Conveyors

Mixing/Dispersing

Pumping/Metering

Safety/Fire Protection

Tinting/Mixing

Services/Equipment

Air Pollution/Effluent Control

Consulting/Testing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It's Time To Choose Bayferrox
In demanding times like these, success is measured by your ability to supply consistent, high-quality products to your customers. Your products are only as good as the materials you use to make them.
The time has come to choose Bayferrox iron oxide pigments produced by Bayer Corporation, here in the United States. Bayer offers:
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Bayferrox from Bayer
Call 1-800-662-2927 for more information. It will be time well spent.
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Educational/Training

Engineering Services

Environ./Regulatory Services

Exposure Testing

Graphic Arts

Inspection Equipment

Publishing

R & D

Safety/Health Services

Solvent Recovery

Spray Booths

Surface Prep./Cleaning/Pretreatment

Tanks

Waste Disposal

Laboratory Apparatus and Testing Equipment

Accelerated Weathering

Balances/Scales

Coatings Application

Color/Optical/Appearance Measurements

Computers/Software

Gages

Lab Mills

Moisture Analyzers

Particle Characterization

Physical/Mechanical

Rheological

Test Charts/Panels

Test/Measurements

SER-AD™ ADDITIVES FOR WATERBORNES

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SER-AD™ coatings additives were developed to be nature-friendly, much as the waterborne coatings in which they're used. When you formulate with these SER-AD products, you will improve finish quality and address issues such as odor, VOCs and harmful compounds.

SER-AD FA 379 is the nitrite-free solution to flash rusting. This anti-corrosive additive forms a monomolecular barrier to protect the metal surface from water and improve coating adhesion. Effective during manufacturing, storage and application, SER-AD FA 379 permanently inhibits corrosion, long after the coating has dried.

SER-AD FX 1070, a VOC-free, unique PUR thickener, increases high-shear viscosity to provide improved brushing characteristics and higher film build for a better coating appearance.

SER-AD FX 511, a low-odor coalescing agent that promotes the formation of continuous films in a broad range of water-reducible resins, stays in the coating longer to help prevent cracking.

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Huls-1987-R1

1996 Expo Exhibitors Description of Exhibits

A.P. DATAWEIGH SYSTEMS 1947
1294 Channings Lake Ct.
Lawrenceville, GA 30243
Phone: 770-682-2002
FAX: 770-682-9090

A.P. Dataweigh Systems manufactures Drum Master portable drum weighers that lift, rotate, and dispense, Bizerba industrial scales & controllers, and weight based batching systems & drum fillers.

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ACETO CORP. 507
One Hollow Lane
Lake Success, NY 11042-1215
Phone: 516-627-6000
FAX: 516-627-6093

Aceto Corporation is offering a wide range of chemicals for the coatings industry, including persulfates, organotin compounds, electrostatic spray-paint additives, UV photoinitiators, azi-ridine-based chemicals, powder coating additives, and dibasic esters.

Circle No. 302 on Reader Service Card

ACT LABORATORIES, INC. 1342
273 Industrial Dr.
Hillsdale, MI 48075
Phone: 517-439-1485
FAX: 517-439-1652

Test panels of various shapes, substrates, and treatment are displayed, including pretreated, ecuated, spray painted, or powder coated. A2LA accredited independent testing services are described.

Circle No. 303 on Reader Service Card

ADHESIVES AGE 2543
29 N. Wacker Dr.
Chicago, IL 60606
Phone: 312-726-2802
FAX: 312-726-2574

Adhesives Age provides adhesive and sealant manufacturers (formulators) and their industrial consumers of adhesives and sealants with technological and scientific information and news concerning the manufacture, application, research, regulations and marketing of adhesives and sealants. Copies of the publication are available.

Circle No. 304 on Reader Service Card

ADVANCED SOFTWARE DESIGNS 725
P.O. Box 647
Chesterfield, MO 63006
Phone: 314-532-6021
FAX: 314-532-2935

Preview WinSNAP, comprehensive Windows®-based formula management software developed to meet the needs of paint and coating manufacturers. Offering a client-server work environment, WinSNAP manages raw material and formula information, assists in product development, and incorporates complete "What-If" analysis and querying capabilities for speed-to-market performance.

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AIR PRODUCTS AND CHEMICALS, INC. 1505
7201 Hamilton Blvd.
Allentown, PA 18195-1501
Phone: 610-481-4911
FAX: 610-481-5900

Featured at this year's booth are water-based and high solids curing agents for compliant epoxy coatings; Dynol™ surfactant for waterborne industrial coatings and Surfynol® surfactants for industrial and architectural coatings; high solids Airthane® polyurethane pre-polymers and Hybridur™ urethane acrylic hybrid dispersions for maintenance coatings; and Airflex® emulsions for low VOC architectural paints.

Circle No. 306 on Reader Service Card

AKZO NOBEL CHEMICALS INC. 840
300 S. Riverside Place
Chicago, IL 60606
Phone: 312-906-7500
FAX: 312-906-7633

Akzo Nobel Chemicals Inc., Polymer Chemicals is featuring a full line of organic peroxide and azo initiators used in polymerization. Technical and sales representatives are available.

Circle No. 307 on Reader Service Card

AKZO NOBEL RESINS 840
2904 Missouri Ave.
E. St. Louis, IL 62205
Phone: 618-271-6601
FAX: 618-874-5601

Akzo Nobel Resins' technical representatives present the latest in resin technology. Featured products for "creating the right chemistry" include emulsions, high solids resins including NCO and NCO free based resins, two-pack water-based systems, rheology modified resins, and other high performance resins for coatings.

Circle No. 308 on Reader Service Card

ALAR ENGINEERING 2439
9651 West 196th St.
Mokena, IL 60448
Phone: 708-479-6100
FAX: 708-479-9059

Alar features Auto-Vac Filter designed to remove virtually all suspended solids from liquid slurries. With the aid of a diatomaceous earth filter media, solid particles as small as 1/2 micron are removed from the liquid being filtered. The solids are continuously removed from the surface of the media by a Stellite knife blade and then deposited into a receptacle for easy disposal. Liquids typically can be safely discharged into the sewer system or can be recycled back to plant operation.

Circle No. 309 on Reader Service Card

ALCAN-TOYO AMERICA, INC. 1818
1717 N. Naper Blvd., Ste. 201
Naperville, IL 60563-8838
Phone: 630-505-2160
FAX: 630-505-2176

Alcan-Toyo highlights latest innovations in aluminum pigment technology for the powder coating and automotive industry.

Circle No. 310 on Reader Service Card

ALLIEDSIGNAL 2816
SPECIALTY CHEMICALS
101 Columbia Rd.
Morristown, NJ 07962
Phone: 201-455-2295
FAX: 201-455-5000

AlliedSignal's Specialty Chemicals Group consists of Riedel-de Haen, Performance Chemicals, Performance Additives, and UOP businesses. Products featured include: ACumist®, A-C® polyethylenes and copolymers, Lumilux® luminescent pigments, and Mergal® industrial preservatives.

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ALNOR OIL CO., INC. 1440
70 E. Sunrise Hwy., Ste. 418
Valley Stream, NY 11581
Phone: 516-561-6146
FAX: 516-561-6123

Alnor Oil imports and distributes vegetable oils and derivatives. Our booth displays these oils, and indicates how they can be purchased.

Circle No. 312 on Reader Service Card

AMBROSE CO. 2825
6001 192nd St., N.E.
Arlington, WA 98223
Phone: 360-435-1141
FAX: 360-435-8200

Ambrose features 1 and 5 gallon filling systems, volumetric, and electronic weight fillers—one gallon to 80 cpm and 5 gallon to 40 cpm. Also highlighted are denesters, lid placers & palletizers for

turn key lines using our patented cone nozzles.

Circle No. 313 on Reader Service Card

AMERICAN CHEMICAL SOCIETY ... 102
INFORMATION & SERVICES
1155 16th St., NW
Washington, D.C. 20036
Phone: 202-872-4453
FAX: 202-872-4435

ACS features information on the benefits of membership: career guidance, employment services, insurance programs, educational materials, short courses and A/V programs, online resources from Chemical Abstracts Service, and safety information. Pick up a handy Internet address guide for electronic access to all our activities, products, and services via our home page on the worldwide web.

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AMERICAN COLORS, INC. 1839
160 E. Market St.
Sandusky, OH 44870
Phone: 419-621-4000
FAX: 419-625-3979

American Colors presents both standard dispersion lines and custom grinding capabilities. Products include waterborne, solvent-based, epoxy, urethanes, and a host of specialty grinds.

Circle No. 315 on Reader Service Card

AMERICAN PAINT & COATINGS JOURNAL 2836
9609 Gayton Rd., Ste. 100
Richmond, VA 23233
Phone: 804-741-6704
FAX: 804-750-2399

Featured are *American Paint & Coatings Journal* and *APCJ Convention Daily*. Check out our line of resource books on display. Subscription forms also available.

Circle No. 316 on Reader Service Card

AMOCO CHEMICALS 2225
200 E. Randolph Dr.
Mail Code 7802
Chicago, IL 60601
Phone: 800-621-4567
FAX: 630-434-6112

Amoco Chemicals features a variety of chemical intermediates for coating resins. These include purified isophthalic acid, trimellitic anhydride, and terephthalic acid, as well as two new products—dimethyl-2,6-naphthalene dicarboxylate (Amoco® NDC) and 5-tertiary butyl isophthalic acid (Amoco® tBIA). As a raw material supplier, Amoco provides starting point formulations for polymers used in environmentally compliant coatings such as UV-curable and low VOC. Additional literature detailing high-solids, waterborne, powder, coil, and coatings for plastics and wood is available.

Circle No. 317 on Reader Service Card

ANGUS CHEMICAL CO. 1023
1500 E. Lake Cook Rd.
Buffalo Grove, IL 60089
Phone: 847-215-8600
FAX: 847-215-8626

ANGUS features multifunctional additives, amines, pigment dispersants, biocides, crosslinkers, solvents, and more.

Circle No. 318 on Reader Service Card

ANKER LABELERS USA INC. 200
705 Live Oak St., Ste. E
Tarpon Springs, FL 34689
Phone: 813-937-0233
FAX: 813-942-8579

Anker is celebrating its first 100 years! The coatings industry has been very good to us. This year we will not display a machine but instead will spend this opportunity to thank you.

Circle No. 319 on Reader Service Card

AQUALON 1842
1313 N. Market St.
Wilmington, DE 19894-0001
Phone: 302-594-5000
FAX: 302-594-6660

Aqualon features the Natrosol® hydroxyethylcellulose family of latex paint rheology modifiers. The Natrosol family includes Natrosol Plus—a rheology modifier combining the universality of HEC with the spatter-free properties of associatives. Also Natrosol FPS® water-soluble polymer suspensions for non-dusting rheology control and Natrosol® B for superior enzyme resistance are highlighted. Hercules ParCell™ nitrocellulose, a resin for wood and metal coatings, is featured.

Circle No. 320 on Reader Service Card

ARAKI IRON WORKS CO., LTD. 2823
c/o Axis Co., Ltd.
105 Mebious Tachiki
35-5, 2-Chome, Nishimachi
Kokubunji-shi, Tokyo 185, Japan
Phone: 81-425-71-2490
FAX: 81-425-73-1263

Araki Iron Works features the "ring mill" dispersion machine for paints and inks. This machine reduces dispersion time, and paint and ink colors can be replaced quickly.

Circle No. 321 on Reader Service Card

ARCO CHEMICAL CO. 1826
3801 West Chester Pike
Newtown Square, PA 19073
Phone: 800-345-0252
FAX: 610-359-2841

ARCO Chemical Company features its complete line of performance chemicals for paint and coatings. Highlighted are non-crystallizing MP-Diol® glycol, which increases flexibility of coil coatings and reduces viscosity for high solids formulations; ARCOSOLV® P-series solvents—non HAPs glycol ethers and acetates—which provide highly effective solvent, coupling, or coalescing performance; and SAA 100/101, which improves gloss, hardness, and chemical resistance in wood finishes.

Circle No. 322 on Reader Service Card

ARIZONA INSTRUMENT CORP. 1144
4114 E. Wood St.
Phoenix, AZ 85040-1941
Phone: 602-470-1414
FAX: 602-470-1888

The Arizona Instruments Corp. features the Computrac® MAX-2000 moisture/solids analyzer that detects moisture levels from 50ppm to 100% and accommodates sample weights as low as 150mg and up to 40 grams.

Circle No. 323 on Reader Service Card

ARIZONA OXIDES 115
1741 E. Morten Ave.
Phoenix, AZ 85020
Phone: 602-944-9494
FAX: 602-944-8930

Arizona Oxides, a new supplier of natural and synthetic iron oxides, makes its first appearance at the International Coatings Expo this year. Stop by our booth to discover fresh, new ideas for the coatings industry.

Circle No. 324 on Reader Service Card

ASHLAND CHEMICAL CO. INDUSTRIAL CHEMICALS & SOLVENTS DIV. 1626
P.O. Box 2219
Columbus, OH 43216
Phone: 614-790-4413
FAX: 614-790-3465

A complete range of formulation ingredients and additives, including coalescents, dispersants, monomers, pigments, pigment dispersions, plasticizers, preservatives, coating resins, resins, silicones, solvents, surfactants, thickeners and other additives specialties from most of the key industry suppliers are featured. All of this is backed by extensive services, from technical guidance in reformulation to full chemical waste management services, and health, safety, and technical services.

Circle No. 325 on Reader Service Card

ASHLAND CHEMICAL CO.
DREW INDUSTRIAL DIV. 1626
One Drew Plaza
Boonton, NJ 07005
Phone: 201-263-7600
FAX: 201-263-4483

The Drew Industrial Division Chemical Additives features value-added foam control agents, specialty waxes, thickeners, and other additives for aqueous paints, coatings and inks. Foam control agents for trade sales paint, high gloss coatings and lacquers will be featured. Highlighted are technical updates on our new associative thickeners/rheology modifiers and self cross-linking specialty waxes. *Drew Perspectives*, a technical/marketing newsletter, and our updated

Supplier Recommendation Index are also available.

Circle No. 326 on Reader Service Card

ATLAS ELECTRIC DEVICES CO. 2023
4114 N. Ravenswood Ave.
Chicago, IL 60613
Phone: 312-327-4520
FAX: 312-327-5787

Atlas presents its new Ci5000 Xenon Weather-Ometer® for exposing paints and coatings to accelerated weathering conditions. The advanced Ci5000 includes proportional temperature and humidity control, an instructional LCD user control panel, automatic irradiance calibration, slide-out components for easy servicing, and a capacity to hold 87 standard 3 x 6 in. test samples.

Circle No. 327 on Reader Service Card

ATOTECH USA INC. 1751
20026 Progress Dr.
Strongsville, OH 44136
Phone: 216-572-7800
FAX: 216-572-7820

Atotech displays their newely designed plastic cyclic corrosion chamber. This chamber is capable of cycling automatically between salt fog, solution spray, high humidity, low humidity with dry off, and ambient conditions in any combination for various lengths of time. Ask about our money saving Ato-Fill System.

Circle No. 328 on Reader Service Card

AZTEC PEROXIDES INC. 2341
One Northwind Plaza
7600 W. Tidwell
Houston, TX 77040
Phone: 800-231-2702

Aztec Peroxides features organic peroxide initiators.

Circle No. 329 on Reader Service Card

B.A.G. CORP. 100
11510 Data Dr.
Dallas, TX 75218
Phone: 800-331-9200
FAX: 214-340-4598

B.A.G. offers the Super Sack Flexible Bulk Container or FIBC for shipping and storage of materials. Also available: Pactainer—Conductive FIBC, M.c.Sack—Square FIBC, Flutainer for liquids, and Waste Away for disposal of waste products.

Circle No. 330 on Reader Service Card

BASF CORP. 818
11501 Stele Creek Rd.
Charlotte, NC 28273
Phone: 704-587-8122

BASF features Acronal® latex resins for architectural coatings, Laroflex®, Laropal®, and Luhydran® specialty resins for industrial coatings, and Laromer® and Lucirin® oligomers and photoinitiators for UV curing.

Circle No. 331 on Reader Service Card

BATCHMASTER SOFTWARE CORP. 2607
1500 Pacific Coast Hwy., Ste. E
Seal Beach, CA 90740
Phone: 310-799-8888
FAX: 310-799-8833

BatchMaster Software Corporation demonstrates their latest Windows®-based modules including their newest interface to NWA's Quality Analyst for complete analysis of BatchMaster's Q/C data.

Circle No. 332 on Reader Service Card

BAYER CORP. 1623
100 Bayer Rd.
Pittsburgh, PA 15205
Phone: 412-777-2516
FAX: 412-777-7626

Bayer Corporation is the manufacturer of Bayferrox synthetic iron oxide pigments, as well as other inorganic and organic pigments, for use in all paint and coatings applications.

Circle No. 333 on Reader Service Card

BERGEN BARREL & DRUM CO. ... 2639
43-45 O'Brien St.
Kearny, NJ 07032
Phone: 201-998-3500
FAX: 201-998-0414

Bergen Barrel designs and manufactures a complete line of rotationally molded polyethylene, on approved open & closed head drums, stationary & transportable tanks, I.B.C.'s and various types of secondary containment products. Also available are replacement bottles & hardware for all types of I.B.C.'s.

Circle No. 334 on Reader Service Card

BLACOH FLUID CONTROL, INC.... 2718
14340 Elsworth St., #120
Moreno Valley, CA 92553
Phone: 909-697-4211
FAX: 909-653-8094

Sentry pulsation dampeners, surge suppressors, and inlet stabilizers take the shock out of fluid flow in paint and chemical pumping processes. Ensure pulse-free flows in paint and coating applications, improve accuracy of in-line meters, and create steady flow to filter media. Sentry protects pipes, valves, fittings, and sensitive equipment from hammer shock, vibration and fatigue pumps, and quick closing valves. For use on all pump types, including piston, diaphragm, peristaltic, metering, and AOD pumps.

Circle No. 335 on Reader Service Card

BORDEN CHEMICAL, INC. 2804
114 Industrial Blvd.
Morganton, NC 28655
Phone: 704-584-3800
FAX: 704-584-3885

Borden Chemical Incorporated offers a wide range of thermosetting melamine and urea resins for crosslinking coatings formulations for wood and metal applications. Technical service laboratories are available to custom develop formulations for specific applications.

Circle No. 336 on Reader Service Card

BOWERS PROCESS EQUIP. INC. ... 540
904 Downie St.
Stratford, Ont., N5A 6T1
Canada
Phone: 519-271-4757
FAX: 519-272-0911

On display are a polished stainless steel process mixing vessel, a high speed disperser, a polished stainless I.B.C, as well as photographs of standard and custom processing equipment.

Circle No. 337 on Reader Service Card

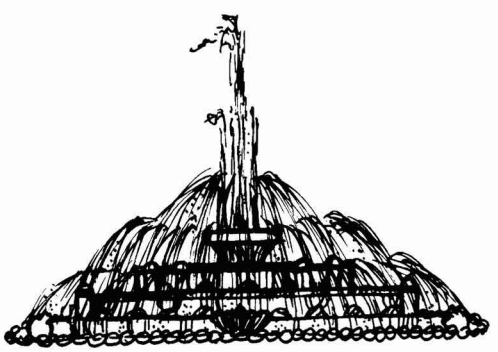
BRITISH STANDARDS INSTITUTION, INC. 2802
8000 Towers Crescent Dr., Ste. 1350
Vienna, VA 22182
Phone: 703-760-7828
FAX: 703-761-2770

British Standards Institution, Inc. (BSI, Inc.), a quality management organization, covers training, testing, standards, product certification, and CE marking. We are accredited for ISO 9000, QS-9000, and ISO bis 14001.

Circle No. 338 on Reader Service Card

BROOKFIELD ENGINEERING LABS., INC. 2044
240 Cushing St.
Stoughton, MA 02072
Phone: 617-344-4310
FAX: 617-344-7141

Brookfield Engineering Laboratories is displaying its line of viscosity equipment. From the KU-1Q (Krebs reading)



viscometer to its high shear cone and plate CAP series viscometers, general purpose laboratory viscometers, and associated accessories. Online process control viscometers are also featured. Visit our booth and meet the Brookfield technical staff who can answer your viscosity measurement questions.

Circle No. 339 on Reader Service Card

BUCKMAN LABS., INC. 1611
1256 N. McLean Blvd.
Memphis, TN 38108
Phone: 800-282-5626
FAX: 901-726-5970

Buckman Laboratories is highlighting several products in their line of specialty chemical additives for the coatings industry. Of particular interest to industrial manufacturers is Butrol 9104, a corrosion inhibitive pigment. Buckman also emphasizes the Busan line of bactericides and fungicides for use in the preservation of architectural and wood protective coatings.

Circle No. 340 on Reader Service Card

BUHLER INC. 1238
1100 Xenium Lane
Minneapolis, MN 55441
Phone: 612-545-1401
FAX: 612-540-9238

Buhler Inc., a developer of dispersion equipment, features technology in raw material handling, mixing, bead milling and three roll milling. On display are the two newest bead mills, i.e, the K60 for high viscosity application and the BOA R5 ceramic for medium viscosity applications.

Circle No. 341 on Reader Service Card

BULKCON SYSTEMS INTERNATIONAL USA LTD. 2041
1751 E. Major Rd.
Custer, MI 49405
Phone: 616-757-2473
FAX: 616-757-2022

Bulkcon Systems is an integrated manufacturer of bulk bags offering 16 standard models with over 96 variations to accommodate most packaging requirements. Custom bags from 25 kg to 2,000 kg are available in a variety of materials. Bulkcon is ISO-9000 since 1987. All bags are 100% recyclable.

Circle No. 342 on Reader Service Card

BURGESS PIGMENT CO. 1537
Beck Blvd., P.O. Box 349
Sandersville, GA 31082
Phone: 912-552-2544
FAX: 912-552-1772

Burgess features visual demonstrations with emphasis on utilizing the Optiwhite series in combination with universal grade TiO_2. Cost savings with Optiwhite MX while improving quality is demonstrated in both interior and exterior applications savings while improving quality interior and exterior formulations.

Circle No. 343 on Reader Service Card

BYK-CHEMIE USA 2018
524 S. Cherry St.
Wallingford, CT 06492
Phone: 203-265-2086
FAX: 203-284-9158

Highlighted this year is the new liquid thixotrope, BYK® 410 for solvent-based and solvent-free coatings. In addition, the wetting and dispersing additives for water-based systems, Disperbyk® 180, Disperbyk® 183, Disperbyk® 184, and Disperbyk® 190 are also featured. Advantages of the new defoamers, BYK® 011 and BYK® LP-D-6569, are displayed. BYK® 375, a new silicone for exterior can coatings, and BYK® 390, an anti-popping additive, is being introduced. Adjacent to our booth, BYK-Gardner is displaying the latest instrumentation for paint technology.

Circle No. 344 on Reader Service Card

BYK-GARDNER USA 2014
2435 Linden Ln.
Silver Spring, MD 20910
Phone: 301-495-7150
FAX: 301-585-4067

BYK-Gardner USA features a complete line of color and appearance testing instruments and classical physical test equipment. This year, BYK-Gardner emphasizes the auto-color family.

Circle No. 345 on Reader Service Card

C.I.P. PRODUCTS/SELLERS CLEANING SYSTEMS 112
1554 Fenpark Dr.
Fenton, MO 63026
Phone: 314-343-5211
FAX: 314-343-9649

Featured is the Sellers Cleaning Systems line of rotary tank cleaning machines. High pressure low volume Sellers' Roto Jet is demonstrated. Operating pressures to 3600 PSI (250 BAR). Custom tank cleaning systems designed and fabricated by C.I.P. Products are displayed.

Circle No. 346 on Reader Service Card

CABOT CORP. 508
CAB-O-SIL & SPECIAL BLACKS DIV.
157 Concord Rd.
Billerica, MA 01821
Phone: 508-663-3455
FAX: 508-670-7035

The Special Blacks Division of Cabot supplies carbon black to the coatings industry with a wide range of products to serve all the major coating industry segments: powder coatings, water-, and solvent-based systems. Cabot Special Blacks is actively engaged in R&D to serve the new trends in these segments.

Circle No. 347 on Reader Service Card

CALGON CORP. 1820
P.O. Box 1346
Pittsburgh, PA 15230
Phone: 908-382-8982
FAX: 908-382-9326

Featured is Calgon's commitment to quality by custom designing biocide programs to meet its customers needs. A variety of safe, effective biocides are available, including combinations in a single package. Our technical staff is on-hand to discuss your specific requirements.

Circle No. 348 on Reader Service Card

CARDOLITE CORP. 1147
500 Doremus Ave.
Newark, NJ 07105-4805
Phone: 201-344-5015
FAX: 201-344-1197

A new phenalkamine, NC-559, for waterborne epoxy metal coatings is featured. NC-559 offers a cost effective system that provides long term corrosion resistance and the ability to cure in very humid conditions.

Circle No. 349 on Reader Service Card

CB MILLS, INC. 1031
1225 Busch Pkwy.
Buffalo Grove, IL 60089
Phone: 847-459-0007
FAX: 847-459-0598

CB Mills is introducing their all new "Red Head" Micro 15 solvent recovery unit at the Expo. Also on display are laboratory and production "Red Head" vertical mills, horizontal Dyno Mills, and "Red Head" tank washer.

Circle No. 350 on Reader Service Card

CCP 419
919 E. 14th Ave.
N. Kansas City, MO 64116
Phone: 816-391-6000
FAX: 816-391-6141

CCP's 1996 display features products from its line of resins and additives designed for the compliance coatings market. Included are NISO systems; HAPs free resins (both conventional and high-solids); high-solids baking polyesters and thixotropic and flow control for high-solids and waterborne systems.

Circle No. 351 on Reader Service Card

CEM CORP. 239
3100 Smith Farm Rd.
Matthews, NC 28105
Phone: 704-821-7015
FAX: 704-821-8710

CEM is exhibiting the LabWave 9000™ which provides solids analysis of adhesives, sealants, latex coatings, pigments, inks, polymers and resins in less than 5 minutes. The MDS 2000™ is designed for acid digestion of inorganic samples for subsequent analysis and the new STAR™ system digests larger samples with different methods at simultaneous or separate start times. The MAS 7000™ Microwave Muffle Furnace reduces ashing times.

Circle No. 352 on Reader Service Card

CENTER FOR APPLIED ENG., INC. 736
10301 Ninth St., N.
St. Petersburg, FL 33716
Phone: 813-578-4316
FAX: 813-578-4280

The Center for Applied Engineering is an NVLAP accredited laboratory providing comprehensive testing, expert witness, and consulting services to the paint & coatings and allied industries. The Center provides formulation, instrumental analysis, failure analysis, accelerated weathering (including Xenon-Arc, QUV, salt spray, cyclic corrosion testing), VOC determination, heavy metal detection, and a wide range of physical property testing. The Center specializes in the evaluation of paints, coatings, sealants, elastomerics, and raw materials.

Circle No. 353 on Reader Service Card

CHEMICAL & ENGINEERING NEWS .. 103
1155 16th St., NW
Washington, DC 20036
Phone: 202-872-4442
FAX: 202-833-7736

Chemical & Engineering News and *Chemcyclopedia,* the comprehensive global directory of commercially available chemicals/suppliers, are the featured American Chemical Society publications along with *Chemical Health & Safety* and *Today's Chemist at Work* magazines and peer-reviewed journals—*Chemistry of Materials, Macromolecules, Organometallics,* and *Langmuir*—the ACS journal devoted to surface and colloid chemistry. Books of interest to the coatings industry and information describing our new electronic products are also featured.

Circle No. 354 on Reader Service Card

CHEMICAL MANUFACTURERS ASSOCIATION 107
1300 Wilson Blvd.
Arlington, VA 22209
Phone: 703-741-5609
FAX: 703-741-6091

The Solvents Council provides materials that discuss (1) the performance benefits of solvent-based coatings and (2) approaches for meeting regulatory requirements while continuing to use proven solvent-based systems and existing application equipment.

Circle No. 355 on Reader Service Card

CHEMICAL MARKETING REPORTER 2803
80 Broad St., 23rd Fl.
New York, NY 10004-2203
Phone: 212-480-4CMR
FAX: 212-248-4901

Chemical Marketing Reporter serves the information needs of the chemical industry targeting mid- and upper-level managers in the corporate ranks, R&D sales, marketing, and purchasing. CMR provides timely hard news accounts regarding mergers, acquisitions, and strategic alliances, chemical expansions, and regulatory matters.

Circle No. 356 on Reader Service Card

CHEMICAL WEEK 2326
888 Seventh Ave., 26th Fl.
New York, NY 10106
Phone: 212-621-4900
FAX: 212-621-4949

Chemical Week, a communications company, reaches worldwide through the 82 year-old *Chemical Week* magazine, its conferences, directories, Buyers' Guide, newsletters, the Custom Manufacturing Expo, and technology (Internet, CD-ROM). It attracts executives in commodity, specialty (including paint and coatings), and service firms.

Circle No. 357 on Reader Service Card

CHEMICALS INCORPORATED 1951
12321 Hatcherville Rd.
Baytown, TX 77521
Phone: 713-576-5000
FAX: 713-576-5712

Chemicals Incorporated manufactures metal carboxylate driers (naphthenates & octoates) bismuth, calcium, cobalt, iron, lead, manganese, zinc and zirconium, and specialty chemicals.

Circle No. 358 on Reader Service Card

CHEMIR/POLYTECH LABS., INC. 340
2672 Metro Blvd.
St. Louis, MO 63043
Phone: 314-291-6620
FAX: 314-291-6630

Chemir/Polytech Laboratories, Inc., utilizes Ph.D. chemists and scientific instrumentation to solve materials identification, deformulation, polymer analysis, failure analysis, and "good vs. bad" product comparison problems. Materials analyzed include plastics, polymers, oils, inks, rubbers, coatings, paints, adhesives, surfactants, and pharmaceuticals.

Circle No. 359 on Reader Service Card

CIBA 1211
ADDITIVES, PIGMENTS & POLYMERS DIV.
540 White Plains Rd.
Tarrytown, NY 10591-9005
Phone: 914-785-2000
FAX: 914-785-4253

Ciba Additives presents data and information on UVAs, HALS, organic corrosion inhibitors and an organic algicide. Several new products within these categories are being introduced and can address our customers' needs from both a performance and environmental aspect. Ciba Pigments is promoting our DPP® and quinacridone pigments for industrial and trade sales coatings. In addition, we are highlighting expansion of our pigments production facilities and the introduction of a new DPP® plant in the United States. Ciba Polymers features our new waterborne epoxy line for high performance systems. Also featured is a new high flow epoxy resin for powder coatings.

Circle No. 360 on Reader Service Card

CIMBAR PERFORMANCE MINERALS 104
25 Old River Rd., S.E.
Cartersville, GA 30120-0250
Phone: 770-387-0319
FAX: 770-386-6785

Cimbar Performance Minerals produces and markets a complete line of barium sulfate products for the coatings and related industries. In addition to these products we are featuring our Suspengel, inorganic thickeners, Organotrol & Vistrol, Organophillic clay products, and

Barifine & Bariace, ultra fine barium sulfate products, introduced at last year's show.

Circle No. 361 on Reader Service Card

CIVACON 339
4595 E. Tech Dr.
Cincinnati, OH 45245
Phone: 513-528-8816
FAX: 513-528-7802

Civacon is exhibiting their line of quick disconnect couplings, quick dry disconnect couplings, and metering deck-batch blending crossover prevention systems.

Circle No. 362 on Reader Service Card

CLARIANT CORP. 406
4000 Monroe Rd.
Charlotte, NC 28205
Phone: 704-331-7000
FAX: 704-331-7718

Built on the foundation of over 100 years of experience as Sandoz Chemicals, Clariant is an ISO manufacturer of pigments and chemicals for coatings, inks, and plastics. Featured products include: Sandorin/Graphtol pigments, Sanduvor UV light stabilizers, and Sandostab P-EPQ antioxidants.

Circle No. 363 on Reader Service Card

CLAWSON CONTAINER CO. 641
4545 Clawson Tank Dr.
Clarkston, MI 48346
Phone: 810-625-8700
FAX: 810-625-3066

Clawson Container Company offers a full line of intermediate bulk containers (IBCs). These units have been designed in cooperation with the paint and coatings industry. On display are the stainless steel jumbo bin and Clawson's next generation of "all polyethylene" containers. Sales and service personnel are available to discuss solutions to your specific needs.

Circle No. 364 on Reader Service Card

CMI INTERNATIONAL 2818
945 Busse Rd.
Elk Grove Village, IL 60007
Phone: 847-439-4404
FAX: 847-439-4425

A complete line of handheld and bench type coating thickness measurement equipment designed for paint and powder coating applications are highlighted.

Circle No. 365 on Reader Service Card

COATINGS MAGAZINE 443
Kay Publishing Co., Ltd.
406 North Service Rd. E., Ste. 1
Oakville, Ont., L6H 5R2
Canada
Phone: 905-844-9773
FAX: 905-844-5672

Coatings Magazine is your access to Canada's $2 billion coatings and finishing markets. Each issue is themed with special coverage for paint & coatings manufacturers and product finishers.

Circle No. 366 on Reader Service Card

COATINGS WORLD/INK WORLD .. 1044
Rodman Publishing
Box 555
175 S. Franklin Tpke.
Ramsey, NJ 07446
Phone: 201-825-2552
FAX: 201-825-0553

Coatings World is a new magazine covering the global paints, coatings, adhesives, and sealants industries. Each issue offers the latest news, in-depth reports, market developments, equipment and the latest technologies. *Ink World* magazine covers the worldwide printing ink industry. Please stop by our booth and receive complimentary copies of both of these exciting new trade journals.

Circle No. 367 on Reader Service Card

COLOR COMMUNICATIONS, INC. 2639
400 W. Fillmore St.
Chicago, IL 60624
Phone: 312-638-1400
FAX: 312-638-0887

Circle No. 368 on Reader Service Card

COLOR CORP. OF AMERICA 2420
1215 Nelson Blvd.
Rockford, IL 61104
Phone: 815-987-3777
FAX: 815-964-0559

Color Corporation is celebrating its 50th year of service to the coatings industry. We are exhibiting our lines of color systems, colorants, and pigment dispersions for the consumer and industrial coatings markets.

Circle No. 369 on Reader Service Card

COLOR INSTRUMENTS, INC. 2721
319 Mola Ave.
Ft. Lauderdale, FL 33301
Phone: 954-525-6044
FAX: 954-525-5963

Color Instruments Inc. features color measurement systems, including laboratory and portable spectrophotometers, with software for quality control as well as exact color matching. Products include the Spectronic Instrument Inc. (formerly Milton Roy Co.) systems.

Circle No. 370 on Reader Service Card

COLORTEC ASSOC., INC. 2606
28 Center St.
Clinton, NJ 08809
Phone: 908-735-2248
FAX: 908-236-7865

ColorTec features the Milton Roy ColorMate™ with Version 8 release of Advanced Windows ColorSoft® Quality Control, Color Formulation, and Batch Correction software. Also highlighted is the ColorTec-PCM, Personal Color Meter. This latest addition to the ColorTec line was designed to measure color, whiteness and brightness for a wide range of color quality control applications.

Circle No. 371 on Reader Service Card

COLUMBIAN CHEMICALS CO. 1938
1600 Parkwood Cir., Ste. 400
Atlanta, GA 30339
Phone: 770-951-5700
FAX: 770-951-5742

Columbian Chemicals Company offers a complete line of high performance raven carbon black for the paint and coatings industry.

Circle No. 372 on Reader Service Card

COMPOSITE PARTICLES, INC. 749
2330 26th St., S.W.
Allentown, PA 18103
Phone: 610-791-9900
FAX: 610-791-2486

Composite Particles features surface activated Vistamer® polymer particles for performance enhancement of paints and coatings. Applications include skid resistance, texture, improved abrasion resistance and toughening. Surface activation creates dispersion and bonding to the matrix polymer.

Circle No. 373 on Reader Service Card

CONSOLIDATED RESEARCH, INC.. 1731
1834 Moroni Dr.
Kingsford, MI 49802
Phone: 906-779-9498
FAX: 906-779-9787

Baby Tigers are back again this year at the Coatings Expo in Consolidated Research Booth 405. Also featured is an exciting new computer based CD-ROM tutorial entitled Sci*Quest*. This personal interactive tutorial uses state-of-the-art multimedia techniques to teach in ways never before dreamed of. You can zoom in on high resolution photographs to examine details. Video clips, animation, and audio will actually take you into the laboratory, plant or coating line. You will be choosing your own tour of the coatings industry, learning at your own pace and actually having fun. There is no better way to learn!

Circle No. 374 on Reader Service Card

CONTAINER MANAGEMENT SERVICES, INC. 123
P.O. Box 1148
Simpsonville, SC 29681
Phone: 864-987-0777
FAX: 864-987-0075

Circle No. 375 on Reader Service Card

CORROSION CONTROL CONSULTANTS & LABS 405
4403 Donker Ct., SE
Kentwood, MI 49512
Phone: 616-940-3112
FAX: 616-940-8139

Corrosion Control offers technical and expert witness services on industrial lead-based coatings and weathering steel problems. Independent paint test facilities feature co-efficient, salt fog, UV-con, prohesion, envirotest, production spray and blasting facilities.

Circle No. 376 on Reader Service Card

CORTEC CORP. 2723
4119 White Bear Pkwy.
St. Paul, MN 55110
Phone: 612-429-1100
FAX: 612-429-1122

Cortec features high performance corrosion inhibiting coatings and additives to coatings.

Circle No. 377 on Reader Service Card

CR MINERALS CORP. 1448
14142 Denver West Pkwy., Ste. 101
Golden, CO 80401
Phone: 303-278-1706
FAX: 303-278-7729

CR Minerals introduces Diafil—an amorphous diatomite flatting pigment. CR Minerals also presents new products for the paint and coatings market. Data sheets and sales literature are available.

Circle No. 378 on Reader Service Card

CROSFIELD CO. 435
101 Ingalls Ave.
Joliet, IL 60435
Phone: 815-727-3651
FAX: 815-727-5312

Crosfield Company is highlighting two new products: GASIL® UV 70C for flatting of UV radiation curable coatings and GASIL® AQ 75N for flatting waterborne coatings. Stop by our booth to view our multi-media presentation showcasing the technology used to produce GASIL silica flatting agents. Technical assistance is available to aid you in selecting the best silica flatting agents for your needs.

Circle No. 379 on Reader Service Card

CYTEC INDUSTRIES INC. 1220
Five Garret Mountain Plaza
West Paterson, NJ 07424
Phone: 201-357-3276
FAX: 201-357-3065

Cytec features its line of resins and additives used in industrial coatings. Cytec's products for the paint and coatings industry are used in automotive OEM, general industrial, can, coil, wood, metal finishing, and appliance coating applications. Cytec has introduced high solids resins, powder coating resins, and aliphatic isocyanates to meet new criteria for high performance and environmentally friendly products.

Circle No. 380 on Reader Service Card

D/L LABORATORIES 1242
116 E. 16th St.
New York, NY 10003-2112
Phone: 212-777-4445
FAX: 212-505-8419

D/L Laboratories specializes in the evaluation of raw materials and finished products in the fields of paints, sealants, and waterproofing. We are the only independent testing and consulting laboratory with ISO approval, accreditation by NVLAP, CGSB, and a license from Los Angeles in the fields of paint and sealants. D/L also provides formulation, technical and legal assistance, VOC testing, QPL testing, and expert testimony.

Circle No. 381 on Reader Service Card

DANIEL PRODUCTS CO., INC. 1011
400 Claremont Ave.
Jersey City, NJ 07304
Phone: 201-432-0800
FAX: 201-432-0266

Daniel Products is exhibiting its complete lines of pigment dispersions, waxes (dispersions, emulsions, and powders), and specialty additives. New for '96: Disperse-Ayd® W-30 dispersant, PTFE micronized waxes, and Dapro® 7007 cobalt drier replacement. The Daniel Products defoamer/interfacial tension modifier kit is also featured.

Circle No. 382 on Reader Service Card

DATACOLOR INTERNATIONAL 606
3735 Beam Rd.
Charlotte, NC 28217
Phone:704-357-0400
FAX: 704-329-9925

Datacolor International is introducing new systems (both computer software and spectrophotometer instruments) for color measurement and color quality control specifically designed for the paint and coatings industry. On display is a broad line of products for providing color management solutions in virtually every application.

Circle No. 383 on Reader Service Card

J. DE VREE & CO. N.V. 1352
Toekomstlaan 10
2170 Merksem
Antwerp, Belgium
Phone: 011-32-3-645-76-90
FAX: 011-32-3-646-48-15

A volumetric dosing machine type V154 for liquids and semi-pastes is highlighted.

Circle No. 384 on Reader Service Card

DEFELSKO CORP. 1151
802 Proctor Ave.
Ogdensburg, NY 13669-0676
Phone: 315- 393-4450
FAX: 315-393-8471

DeFelsko features the following: PosiTector 100–coating thickness gage for non-metal substrates; PosiTector 6000–coating thickness gage for all metal substrates; PosiTest 1000–coating thickness gage, data collector, & analysis tool; PosiTest–coating thickness gage for non-magnetic coatings on steel; PosiPen–coatings thickness gage for non-magnetic coating on steel; PosiSoft Windows® software for detailed statistical analysis; and HP IR wireless printer.

Circle No. 385 on Reader Service Card

DEGUSSA CORP. 2200
65 Challenger Rd.
Ridgefield Park, NJ 07660
Phone: 201-641-6100
FAX: 201-807-3183

Numerous high performance products for the paint and coatings industry are featured at Degussa Corp.'s booth. Products include: Aerosil® fumed silicas, Acematt® flatting agents, Degamin IPDA® isophorone diamine, and specialty carbon blacks.

Circle No. 386 on Reader Service Card

UNIVERSITY OF DETROIT-MERCY POLYMER INSTITUTE 126
4001 W. McNichols Rd.
P.O. Box 19900
Detroit, MI 48219-0900
Phone: 313-993-6109
FAX: 313-993-6007

Circle No. 387 on Reader Service Card

D.I.R.T. SYSTEMS DIV. OF MICROVIEW USA INC. 2720
650 North Dixie Dr.
P.O. Box 397
Vandalia, OH 45377
Phone: 513-264-1050
FAX: 513-264-1899

D.I.R.T. Systems has designed a system for the visual inspection measurement of coating dirt defects. Using D.I.R.T.™ for Windows, the user can save a defect image and store this to the visual database to form an on-line defect library that can be shared via most any network. Come and see the DIRT team™ today.

Circle No. 388 on Reader Service Card

DISTI-KLEEN, INC. 1638
358 Nye Ave.
Irvington, NJ 07111
Phone: 201-372-1500
FAX: 201-372-8311

Disti-Kleen displays a Robus tank washer, SP50 tank and tote tank washing system, M20 solvent recovery system, and a Vanwyk color dispensing system. Descriptive information on all washing and solvent recovery systems is available.

Circle No. 389 on Reader Service Card

DOMINION COLOUR CORP. 620
1800 Ironstone Manor, Unit 2
Pickering, Ont. L1W 3J9
Canada
Phone: 905-837-4000
FAX: 905-837-2859

DCC exhibits its range of organic and anti-corrosive pigments. The organic range includes new products specifically designed for coatings applications such as PY.151 [DCC 7151], an opaque grade PY.74 [DCC 7074], PO.16 [DCC 1816], and a complete range of Hansa yellows. The LF Bowsei range of anti-corrosive pigments are non-toxic, non-heavy metal containing pigments for water- and solvent-based coatings. DCC's inorganic line includes the range of regular, stir-in, pre-darkened, sulfur dioxide resistant, and silica encapsulated lead chromate pigments. Sales, marketing, and technical staff are available at DCC's booth to answer any questions.

Circle No. 390 on Reader Service Card

DOVER CHEMICAL CORP. 1150
3676 Davis Rd.
Dover, OH 44622
Phone: 800-321-8805
FAX: 330-364-1579

Dover Chemical Corp. manufactures specialty chemicals for formulation in paints and coatings.

Circle No. 391 on Reader Service Card

THE DOW CHEMICAL CO. 1800
100 Larkin Center
Midland, MI 48674
Phone: 517-636-0784
FAX: 517-636-8033

Dow exhibits acrylic latexes for architectural, metal, wood, and traffic paints; P-series glycol ethers including a new TPNP product as well as Proglyde DMM; and the epoxy resin group offers a look at resin technology soon to come from Dow.

Circle No. 392 on Reader Service Card

DOW CORNING CORP. 427
P.O. Box 0994
Midland, MI 48686-0994
Phone: 517-496-4000
FAX: 517-496-4586

Dow Corning Corporation exhibits silicone resin technology, silicon based additives, and water repellents. Products include antifoams, surfactants, adhesion promoters, pigment treatments, leveling agents, water repellents and resins for paints, coatings, & inks. New specialty additives are featured.

Circle No. 393 on Reader Service Card

DRAISWERKE, INC. 2000
40 Whitney Rd.
Mahwah, NJ 07430
Phone: 201-847-0600
FAX: 201-847-0606

Draiswerke, Inc. exhibits (1) a high-performance media mill, DCP-Megaflow 170-C, (double cylinder design) with double surfaces of rotor & stator pegs, mill system for re-circulating and single pass grinding; (2) PM-DDA Direct Dispersion Mill (continuous feed, premix unit eliminates large premix tanks & dispersers); and (3) PM-1 H/V Laboratory Media Mill (ideal for laboratory & development work).

Circle No. 394 on Reader Service Card

DRAIS GMBH DIV. OF EIRICH MACHINES, INC. 2643
4033 Ryan Rd.
Gurnee, IL 60031
Phone: 847-336-2444
FAX: 847-336-0914

Drais/Eirich Group displays the new PM Supertex series horizontal media mill featuring the latest developments in horizontal milling technology. Also shown are the DCP-Superflow mills in various sizes including a 150 HP model and a bag dump work station. Literature for the entire line of original Drais equipment is available.

Circle No. 395 on Reader Service Card

DRY BRANCH KAOLIN CO. 2323
Route #1, Box 468-D
Dry Branch, GA 31020
Phone: 912-750-3500
FAX: 912-746-0217

Featured in this exhibit are kaolin products specifically created for the coatings industry with particular emphasis on maximum opacifying TiO_2 extenders and high efficiency flatting pigments. Dry Branch Kaolin Company is ISO-9001 certified and offers almost 100 years of experience in processing kaolin products.

Circle No. 396 on Reader Service Card

DUPONT NYLON INTERMEDIATES & SPECIALTIES 1551
P.O. Box 80024
Barley Mill 24
Wilmington, DE 19880-0024
Phone: 302-892-0890
FAX: 302-892-0777

DuPont features a new line of specialty diols, dimethylpiperidone, a new solvent, dodecanedioic acid for powder coatings, and Abcite® HP thermoplastic powder coating resins. Information about DuPont's other monomers, solvents, and crosslinkers is available.

Circle No. 397 on Reader Service Card

DUPONT PERFORMANCE CHEMICALS 1651
Chambers Works
Deepwater, NJ 08023
Phone: 800-441-9508
FAX: 609-540-3886

DuPont Performance Chemicals features fluorochemical additives to provide durable oil and water repellency, low surface energies, easier wetting, anti-cratering, and specialty powder additives to provide static dissipation, conductivity, low toxicity antimicrobial effects.

Circle No. 398 on Reader Service Card

EAGLE ZINC CO. 735
30 Rockefeller Plaza
New York, NY 10112
Phone: 212-582-0420
FAX: 212-582-3412

Eagle Zinc manufactures American Process, lead-free zinc oxides for the paint and coatings industry. Grades 414W and 417W are used in exterior house paints for protection against mildew and improved color retention and durability. Applications include water- and solvent-based paints. Meadowbrook Company, Spelter, WV, manufactures low-micron, high-metallic zinc dust. Special coatings grades include 330L, 335L, and M14L. A premium grade of low-lead zinc dust with typical lead content of 0.01 percent is available.

Circle No. 399 on Reader Service Card

EASTERN MICHIGAN UNIVERSITY 131
122 Sill Hall
Ypsilanti, MI 48197
Phone: 313-487-1235
FAX: 313-487-6947

EMU is available to address inquiries on the academic program (BS & MS degrees), National Science Foundation Coating Center, Emission Evaluation Center, and the Coating Research Institute.

Circle No. 400 on Reader Service Card

EASTMAN CHEMICAL CO. 1019
P.O. Box 431
Kingsport, TN 37662
Phone: 800-327-8626
FAX: 423-229-1196

Eastman Chemical Company presents products for use in architectural, automotive (OEM and refinish), general metal (appliance, coil, can, etc.), wood, plastics, and industrial maintenance coatings applications. Eastman's product line offers solvents, resin intermediates, cellulose esters, chlorinated polyolefins, and additives to meet the needs of coatings end uses worldwide. The latest information on the benefits of Texanol ester alcohol, 1,4-CHDA-HP, HPHP, cellulose esters, and specialty solvents is available. Visit the booth to obtain details on the uses of Eastman products in solvent-borne, waterborne, and powder coatings technologies.

Circle No. 401 on Reader Service Card

EBONEX CORP. 1838
2380 S. Wabash
Melvindale, MI 48122
Phone: 313-388-0060
FAX: 313-388-6495

Ebonex Corporation offers a specialty black pigment, cosmic black, for use in areas where traditional carbon blacks will not suffice. We provide dry pigment and aqueous dispersions of cosmic blacks and aqueous carbon black dispersions.

Circle No. 402 on Reader Service Card

ECC INTERNATIONAL 844
100 Mansell Ct., E., Ste. 300
Roswell, GA 30076
Phone: 770-594-0660
FAX: 770-645-3384

Get "TKO" (total kaolin optimization) results with ECC International's new line of kaolin/aluminum silicates featuring Polestar® (calcined) and ECCA-Tex® (delaminated) and water washed clays. Also featured are our calcium carbonates such as Atomite and Camel-Carb®. Stop by booth #844 to discuss your extender pigment needs.

Circle No. 403 on Reader Service Card

EIGER MACHINERY, INC. 316
1888 E. Belvidere Rd.
Grayslake, IL 60030
Phone: 847-548-0044
FAX: 847-548-0099

Eiger exhibits laboratory and production bead mills, dispersers and mixers. Included will be the "Mini" mill, an industry standard for laboratory research and development. New equipment displayed includes a variable speed lab disperser, twin column pilot/production mixer/disperser, and "Maxi" 10 liter self pumping production mill. The production "Maxi" self pumping arrangement provides single pass operation or re-circulation. Available with 5, 10 & 20 liter chambers, a twin cartridge bead separator, quick release chamber and end plate closures. Eiger's other process equipment is available along with representatives to discuss your applications or upcoming projects.

Circle No. 404 on Reader Service Card

ELF ATOCHEM NORTH AMERICA, INC. 1847
2000 Market St.
Philadelphia, PA 19103-3222
Phone: 215-419-7000
FAX: 215-419-7930

Elf Atochem North America, Inc., offers a broad line of products including: Orgasol® ultra fine polyamide powders, Poly bd® resins, styrene maleic (SMA®) resins, Fascat® esterification catalysts, methane sulfonic acid (MSA), alkylamines & alkyl alkanolamines, benzyl alcohol, benzophenone, liquid phenones, dimethyl sulfoxide (DMSO), organic peroxides, and polymer stabilizer systems.

Circle No. 405 on Reader Service Card

ELT (ELECTRONIC LABEL TECHNOLOGY) 2144
708 W. Kenosha
Broken Arrow, OK 74012
Phone: 918-258-2121

Circle No. 406 on Reader Service Card

EMCO CHEMICAL DISTS. INC. 1550
2100 Commonwealth Ave.
N. Chicago, IL 60064
Phone: 847-689-2200
FAX: 847-689-8470

Emco Chemical Distributors has four divisions: Industrial Chemicals, Specialty Chemicals, Custom Packaging, and Waste Services. We provide a full line of both industrial chemicals and specialty chemicals along with the ability to blend, compound, and package any of these products in various size containers. In addition, we can dispose of our customers' waste, both non-hazardous and hazardous.

Circle No. 407 on Reader Service Card

ENGELHARD CORP. 849
(now including The Mearl Corp.)
101 Wood Ave.
Iselin, NJ 08830
Phone: 908-205-5000
FAX: 908-205-6711

The Engelhard booth showcases, for the first time, Mearl™ mica pearl pigments, along with Engelhard's existing portfolio of organic and inorganic color pigments and dispersions, universal colorants, attapulgite thixo-tropes, and mica- and kaolin-based extenders and performance additives. Engelhard acquired the Mearl Corporation in May, 1996.

Circle No. 408 on Reader Service Card

EPS (ENGINEERED POLYMER SOLUTIONS) 1815
1400 N. State St.
Marengo, IL 60152
Phone: 800-601-8111
FAX: 815-568-4820

The EPS booth focuses on high performance emulsions, polyesters, and water reducible alkyd resins. Particular emphasis is placed on VOC and HAPs compliance.

Circle No. 409 on Reader Service Card

EPWORTH MFG. CO., INC. 2047
1400 Kalamazoo St.
South Haven, MI 49090
Phone: 616-637-2128
FAX: 616-637-3421

Now that the meger between Epworth and Morehouse-COWLES is complete, they display two separate models of the "zinger" horizontal media mill with its rotor and chamber design, the "Viscomax" multi-shaft disperser, the new "Cowles" dissolver, and various accessories used in the coatings industry.

Circle No. 410 on Reader Service Card

ERICHSEN INSTRUMENTS 117
1340 Home Ave.
Akron, OH 44310
Phone: 330-633-3644
FAX: 330-633-1977

Erichsen has supplied test equipment since 1910. Our instrumentation includes corrosion chambers, Erichsen cupping testers, humidity cabinets, impact testers, grind gauges, glossmeters, thickness gauges, and much more. T.J. Bell, Inc. is the exclusive North American distributor.

Circle No. 411 on Reader Service Card

ERIE CHEMICAL SALES 1143
205 Worcester Ct.
Falmouth, MA 02540
Phone: 508-457-1000
FAX: 508-457-1010

From coast to coast, Erie Chemical Sales is active in the purchase and sale of surplus and obsolete raw materials in the chemical industry. For 50 years, we have served in resource management.

Circle No. 412 on Reader Service Card

EUREA, GERMANY 2040
1751 E. Major Rd.
Custer, MI 49405
Phone: 616-757-2473
FAX: 616-757-2022

Eurea, Germany is a manufacturer of conductive bulk bags and liners. Protect yourself and your customer from electrostatic ignition dangers. Conductive bulk bags are available in baffled and sift proof styles for light, low density products. Eurea also specializes in UN certified bulk bags for shipping hazardous products.

Circle No. 413 on Reader Service Card

EUROPEAN COATINGS JOURNAL 524
Schiffgraben 43
30175 Hannover, Lower Saxony
Germany, D-3000
Phone: 49 (511) 9910 260
FAX: 49 (511) 9910 299

European Coatings Journal, written in both English and French, is a forum for coatings, inks, and sealants manufacturers and their suppliers. Each issue contains raw material quotations and trend reports, comprehensive product news, original technical articles, regular buyers' guides and reviews of patents, literature and events, complimentary problem solving service, and exclusive study tours.

Circle No. 414 on Reader Service Card

EXXON CHEMICAL CO. 1430
13501 Katy Freeway
Houston, TX 77079
Phone: 713-870-6591
FAX: 713-870-6353

Exxon Chemical features a new product, Exx-RD™ reactive diluent, developed to lower VOCs without compromising coatings performance. Also high-

lighted are Glydexy® glycidyl esters and performance fluids including Isopar® solvents, aromatics, Exxsol® D solvent as well as Exxate® solvents.

Circle No. 415 on Reader Service Card

FABRICATED METALS 2445
12 Union St.
Modena, PA 19358
Phone: 800-356-9167
FAX: 610-383-9030

Fabricated Metals features two 500 lb. shipping containers.

Circle No. 416 on Reader Service Card

FAWCETT CO., INC. 1452
3863 Congress Pkwy.
Richfield, OH 44286
Phone: 216-659-4187
FAX 216-659-6991

Circle No. 417 on Reader Service Card

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY 611
492 Norristown Rd.
Blue Bell, PA 19422-2350
Phone: 610-940-0777
FAX: 610-940-0292

The "FSCT Resource Center" offers information on a complete line of industry publications, educational materials, and professional development services produced by the Federation. Daily demonstrations and information are available on "SciQuest," a CD-ROM industry tutorial for the new and seasoned industry professional. Attractive discounts are available on FSCT publications which can be purchased at the FSCT Store during the Expo. Details on the Federation's 1997 Annual Meeting and International Coatings Expo and Technology Conference will be available to exhibitors. 1997's Expo will mark the FSCT's 75th year and will be held at the Georgia World Congress Center in Atlanta, Georgia, November 3-5.

Circle No. 418 on Reader Service Card

FILLITE 2815
1064 Westwell Run
Alpharetta, GA 30202
Phone: 770-569-8535
FAX: 770-569-8565

Fillite is a lightweight, hollow, silicate sphere with low resin demand. Fillite features low oil absorption and a spherical shape. In water-based systems, shrinkage is reduced resulting in less application time and cost. In industries where weight reduction is critical, such as automotive, marine, and aerospace, the use of Fillite can lead to greater fuel efficiency.

Circle No. 419 on Reader Service Card

FILTER SPECIALISTS, INC. 416
P.O. Box 735
Michigan City, IN 46360
Phone: 219-879-3307
FAX: 219-877-0632

Filter Specialists, Inc. features liquid filtration products, pressure vessels for cartridge, and bag filtration. Also highlighted are microfiber cartridges, wound cartridges, felt and mesh filter bags.

Circle No. 420 on Reader Service Card

FISCHER TECHNOLOGY, INC. 2637
750 Marshall Phelps Rd.
Windsor, CT 06095
Phone: 800-243-8417
FAX: 203-688-8496

Fischer Technology is exhibiting handheld and modular designed instruments to measure paint coatings over aluminum or steel substrates. Featured is the H-100 Micro-indentation system. Ultra low load hardness test results can be physically and meaningfully interpreted. This system is usable on all materials, and produces additional information on specific material properties, i.e., elastic/viscoelastic behavior and creep tendency from a single indentation.

Circle No. 421 on Reader Service Card

FLUID MANAGEMENT 1811
1023 Wheeling Rd.
Wheeling, IL 60090
Phone: 847-537-0880
FAX: 847-537-3221

Gravimetric and volumetric colorant dispensers, paint intermix systems, along with our line of high speed mixers are featured.

Circle No. 422 on Reader Service Card

FMJ INTERNATIONAL PUBLICATIONS LTD. 1940
Queensway House, 2 Queensway
Redhill, Surrey RH1 1QS
England
Phone: 44-737-768611
FAX: 44-737-761685

FMJ publishes several titles for the coatings industry including the European magazine *Polymers Paint Colour Journal* and the global *Paint & Ink International*. Details on FMJ's coatings exhibitions around the world are available.

Circle No. 423 on Reader Service Card

FUJI SILYSIA CHEMICAL, LTD. 1741
121 S.W. Morrison St., Ste. 865
Portland, OR 97204
Phone: 503-295-1933
FAX: 503-295-1832

Fuji Silysia Chemical, Ltd., exhibits their line of micronized synthetic silica flatting agents, sylysia. Fuji Silysia offers flatting silicas for a variety of systems, including solvent-based, waterborne, and high-solids coatings.

Circle No. 424 on Reader Service Card

H.B. FULLER CO. 1038
3530 Lexington Ave., N.
St. Paul, MN 55126
Phone: 612-481-1835
FAX: 612-481-1828

The H.B. Fuller Company exhibits its PD-0450 all-acrylic latex for exterior trim housepaint based on our novel wet adhesion monomer technology. Also featured are our high solids, all-acrylic latex PD-0449, plus our high gloss maintenance coating latex PD-0600, and our styrene acrylic latex PN-3691-M developed for concrete coatings.

Circle No. 425 on Reader Service Card

GAF FILTER SYSTEMS 430
1361 Alps Rd.
Wayne, NJ 07470
Phone: 201-628-3825
FAX: 201-628-4117

GAF's liquid bag filters are designed to improve paint purity, remove harmful contaminants, protect equipment, and reduce maintenance costs.

Circle No. 426 on Reader Service Card

GAMRY INSTRUMENTS, INC. 1351
607-C1 Easton Rd.
Willow Grove, PA 19090
Phone: 215-830-9886
FAX: 215-830-9877

Gamry Instruments, Inc. is showing a

computerized line of electrochemical measurement systems capable of testing and evaluating coating performance and corrosion characteristics. Gamry's EIS900 system, which is designed for evaluating coating characteristics, is displayed.

Circle No. 427 on Reader Service Card

PAUL N. GARDNER CO., INC. 718
316 N.E. First St.
Pompano Beach, FL 33060
Phone: 954-946-9454
FAX: 954-946-9309

Gardner Mini-Cat #17, featuring many new items, is available. Also, register for the 61st anniversary catalog. On display are the Positest 1000 coating thickness gage, minimum film form temp. bar, Gardco WearTester, and lab & field test instruments. Stop by and enter drawing for set of EZ viscosity cups, and ?? mini-mystery prize??

Circle No. 428 on Reader Service Card

GARRISON INDUSTRIES, INC. 111
181 Cooper Rd.
El Dorado, AR 71730
Phone: 501- 862-5692
FAX: 501-862-9628

Garrison Industries, Inc. is a domestic manufacturer of UV absorbers for the coatings industry. Garrison offers a variety of synthetic organic chemical capabilities, with a particular expertise in the production of di-, tri-, and tetra- substituted benzophenone chemicals. In addition we are a supplier of diphenylacrylate UV absorbers.

Circle No. 429 on Reader Service Card

GEORGIA-PACIFIC RESINS, INC. . 1541
2883 Miller Rd.
Decatur, GA 30035
Phone: 770-593-6869
FAX: 770-322-9973

Georgia-Pacific Resins, Inc. (GPRI) reveals its new resin technology. The new technology offers a combination of hardness, toughness, and adhesion with diverse functionality and formulating latitude. GPRI also features its line of solvent-based, waterborne, and specialty coatings and air-dry varnishes.

Circle No. 430 on Reader Service Card

THE BFGOODRICH CO. 1618
SPECIALTY CHEMICALS
9911 Brecksville Rd.
Cleveland, OH 44141-3247
Phone: 216-447-5000
FAX: 216-447-5770

BFGoodrich features its line of waterborne polymers. Carboset® acrylic emulsions and Sancure® polyurethane dispersions for architectural and industrial coatings and graphic arts are highlighted. Permax™ VDC emulsions are featured for high performance maintenance coatings. Coatings polymers are presented for metal, plastic, and wood and temporary strippable and peelable coatings. Carboflow® specialty coatings additives are also presented.

Circle No. 431 on Reader Service Card

THE GOODYEAR TIRE & RUBBER CO.
CHEMICAL DIV. 2218
1485 E. Archwood Ave.
Akron, OH 44306
Phone: 330-796-6401
FAX: 330-796-2617

Goodyear displays a variety of applications for their Pliolite solvent-based, Plioway low odor aliphatic solvent-based, and Pliotec water-based coatings resin systems. The new water-based multicolor system is featured along with the traditional concrete and metal coatings areas. For low odor aliphatic solvent applications, stain blockers and multicolor are featured.

Circle No. 432 on Reader Service Card

GRACE DAVISON 1835
10 E. Baltimore St.
Baltimore, MD 21202
Phone: 410-659-9000
FAX: 410-659-9213

Grace Davison introduces new high performance Syloid® silica flatting agents C809, C810, and C812 for coil and general industrial coatings, as well as new products for waterborne and conventional wood finishes.

Circle No. 433 on Reader Service Card

GRACO INC. 2248
4050 Olson Memorial Hwy.
Golden Valley, MN 55422
Phone: 612-623-6705
FAX: 612-623-6951

Graco is exhibiting the Husky air operated double diaphragm pumps, gravimetric batch dispensing system and drum agitator/transfer packages. Graco has over 45 years of experience in the transfer, dispensing, and mixing of paints, glues, resins, pigments, solvents, adhesives, latex and titanium dioxide. Stop by the Graco booth #2248 and see how Graco can help you solve your transferring, dispensing, and mixing problems.

Circle No. 434 on Reader Service Card

HAAKE, INC. 2325
53 W. Century Rd.
Paramus, NJ 07652
Phone: 800-631-1369
FAX: 201-265-1977

HAAKE is exhibiting its line of rheological and thermal analysis instrumentation. Rotational viscometers and rheometers for characterizing the visco-elastic properties of coatings and dynamic mechanical analyzers for measuring mechanical properties of coatings are also featured.

Circle No. 435 on Reader Service Card

HALOX 2003
1326 Summer St.
Hammond, IN 46320
Phone: 219-933-1560
FAX: 219-933-1570

Halox provides information on inhibitive pigments including: SZP-391 and CW-491 corrosion inhibitors. Our XTAIN line of products is very effective for tannin stain inhibition. We offer proven replacements for zinc and chromates!

Circle No. 436 on Reader Service Card

HAMPSHIRE CHEMICAL CORP. 2814
55 Hayden Ave.
Lexington, MA 02173
Phone: 617-861-9700
FAX: 617-862-3517

Hampshire Chemical Corp. presents information on various water-based polymer products, as well as synthesis capabilities.

Circle No. 437 on Reader Service Card

J.W. HANSON CO., INC. 235
144 Woodbury Rd.
Woodbury, NY 11797
Phone: 516-692-6890
FAX: 516-692-6865

J.W. Hanson Co., Inc., provides samples for customers.

Circle No. 438 on Reader Service Card

HARCROS PIGMENTS INC. 1806
11 Executive Dr.,
Fairview Heights, IL 62208
Phone: 800-323-7796
FAX: 618-628-1029

Harcros Pigments introduces Ultrayellow™ iron oxide pigments and a new light shade copperas red iron oxide, R1099. The new yellow oxides exhibit superior dispersion characteristics and improved rheology properties.

Circle No. 439 on Reader Service Card

HEDWIN CORP. 2705
1600 Roland Heights Ave.
Baltimore, MD 21211
Phone: 800-638-1012
FAX: 410-889-5189

Hedwin manufactures a family of liner products designed to protect products/materials being packaged and/or processed in pails and drums. Also manufactures flexible and blow molded containers.

Circle No. 440 on Reader Service Card

HENKEL CORP. 1223
300 Brookside Ave.
Ambler, PA 19002
Phone: 215-628-1000
FAX: 215-628-1111

Henkel introduces several new products to its product line, including a dispersant, a rheology modifier, and a resin. Sovermol polyols and Waterpoxy epoxy

resin systems are also featured, along with the company's additives, resins, and epoxy curing agent lines.

Circle No. 441 on Reader Service Card

HERO INDUSTRIES LTD. 230
2719 Lake City Way
Burnaby, B.C., V4A 7K2
Canada
Phone: 604-420-6543
FAX: 604-420-8725

HERO Industries manufactures manual paint colorant dispensing equipment. Pumps range from 2 oz. dispense to 7 oz. dispense or 21 oz. dispense on our industrial tinting equipment.

Circle No. 442 on Reader Service Card

HEUCOTECH LTD. 330
99 Newbold Rd.
Fairless Hills, PA 19030
Phone: 215-736-0712
FAX: 215-736-2249

Heucotech is pleased to introduce ZCP and SRPP to the Heucophos Third Generation for use in industrial, coil, and aircraft applications. Also exhibited is the newest phthalocyanine pigments from the Heubach Group.

Circle No. 443 on Reader Service Card

HI-MAR SPECIALTIES, INC.. 1042
1955 Lake Park Dr., Ste. 250
Smyrna, GA 30080
Phone: 800-449-1204
FAX: 770-801-1586

Hi-Mar Specialties, Inc. (formerly Hickson Specialties, Inc.) offers a line of additives for the coatings market. Included are defoamers, dispersants, and wetting agents. Complete laboratory facilities are available for custom designing defoamers to meet specific requirements and for troubleshooting formulation problems. Put us to the test. Contact an HSI representative at 800-449-1204.

Circle No. 444 on Reader Service Card

HILTON DAVIS CO. 600
2235 Langdon Farm Rd.
Cincinnati, OH 45237-4790
Phone: 800-477-1022
FAX: 513-841-3771

Hilton Davis specializes in low VOC, high-solids, alkyds, acrylic, and plastic dispersions. Sales, technical, and management personnel are available to assist you at our booth.

Circle No. 445 on Reader Service Card

HOCKMEYER EQUIP. CORP. 1247
610 Worthington Ave.
Harrison, NJ 07029
Phone: 201-482-0225
FAX: 201-484-6114

Hockmeyer presents its entire product line of mixing, dispersing, washing, and milling equipment. The new process management system is being demonstrated by monitoring power and temperature while operating an HM1 advanced milling system.

Circle No. 446 on Reader Service Card

HOECHST CELANESE CORP. 2035
500 Washington St.
Coventry, RI 02816
Phone: 401-823-2712
FAX: 401-823-2700

The pigments, resins and waxes businesses of Hoechst Celanese highlight products for waterborne coatings. Sales, technical, and marketing representatives are available to answer your questions. Stop by and pick up our latest entry into the Hoechst "Pigments Hall of Fame."

Circle No. 447 on Reader Service Card

HORIBA INSTRUMENTS 506
17671 Armstrong Ave.
Irvine, CA 92614
Phone: 714-250-4811
FAX: 714-250-0924

Particle characterization instruments including: (1) light-scattering particle size analyzers; (2) surface area analyzers; (3) centrifugal sedimentation particle size analyzers and (4) gas pycnometers are on display.

Circle No. 448 on Reader Service Card

J.M. HUBER CORP. 1831
ENGINEERED MINERAL DIV.
One Huber Rd.
Macon, GA 31298
Phone: 912-745-4751
FAX: 912-745-1116

The Engineered Minerals Division of J.M. Huber Corporation offers a wide variety of mineral solutions for the architectural, industrial, and powder coatings customer including ultrafine calcium carbonate, high brightness alumina trihydrate, high purity barium sulfate, and ultrafine, structured, and hydrous kaolin clays.

Circle No. 449 on Reader Service Card

HÜLS AMERICA, INC. 2006
220 Davidson Ave.
Somerset, NJ 08873
Phone: 800-FOR-HULS
FAX: 908-560-6707

Hüls America features its architectural and industrial color systems, high-solids colorant dispersions, aliphatic isocyanates, diamine epoxy hardener raw materials, powder coating crosslinkers, methacrylic polymers and monomers, and a comprehensive line of additives including driers, fungicides, preservatives, thickening agents, and defoamers. Also highlighted is its high purity of silanes, silicates, and silicones.

Circle No. 450 on Reader Service Card

HUNTERLAB 1231
11491 Sunset Hills Rd.
Reston, VA 20190
Phone: 703-471-6870
FAX: 703-471-4237

HunterLab, a manufacturer of color and appearance measurement systems, is exhibiting technology available for color quality control.

Circle No. 451 on Reader Service Card

HUNTSMAN PETROCHEMICAL CORP. 1427
3040 Post Oak Blvd.
Houston, TX 77056
Phone: 713-235-6000
FAX: 713-235-6437

Huntsman Petrochemical Corp. displays the company's product line for use in coating applications— Jeffamine® products, Jeffox® products, Jeffsor® products, and Surfonic® products.

Circle No. 452 on Reader Service Card

ICIS-LOR 106
3730 Kirby Dr., Ste. 1030
Houston, TX 77098
Phone: 713-525-2600
FAX: 713-525-2659

ICIS-LOR provides weekly pricing and monthly plant shutdown data for chemical commodities. In addition, ICIS reports daily on the oil and products markets. Our worldwide editorial team, based in the US, Europe, and Asia, researches the market daily to gain accurate pricing, market, supply/demand forces, & production data. Available by Internet.

Circle No. 453 on Reader Service Card

IDEAL EQUIPMENT CO. 1952
3715 Northcrest Rd., #7
Atlanta, GA 30340
Phone: 770-455-0624
FAX: 770-454-9567

Ideal provides shink wrapped samples of cans of paint wrapped in thick polyethylene film. Film cost per case is approximately eight cents. Considerable savings on material vs. corrugated boxes and labor is described.

Circle No. 454 on Reader Service Card

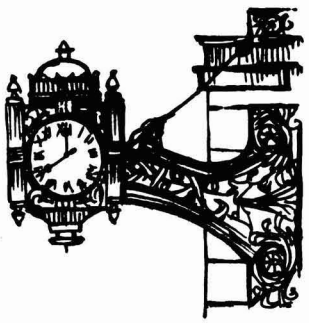
IDEAL MFG. & SALES CORP. 2604
1118 O'Neill Ave.
Madison, WI 53704
Phone: 608-241-1118
FAX: 608-241-4448

A net weight filling and closing machine for open top containers is displayed. A place for Armlok overseals is featured. Picture books in the booth show many products for filling containers, and placing and sealing lids. Automatic and semi-automatic volumetric and net weight filling machines for 1/2 pint to 55 gallon drums are included.

Circle No. 455 on Reader Service Card

IGT REPROTEST, INC. 1852
1450 E. American Ln., Ste. 1400
Schaumburg, IL 60173
Phone: 847-330-6322
FAX: 847-330-6394

IGT Reprotest builds printability testing machines for the testing of inks and coatings. The equipment reproduces



printing conditions on small quantities of materials.

Circle No. 456 on Reader Service Card

INDCO, INC. 341
4040 Earnings Way
New Albany, IN 47150
Phone: 812-945-4383
FAX: 812-944-9742

Industrial mixing equipment including paint shakers, mixers, propellers, dispersers, & accessories are displayed.

Circle No. 457 on Reader Service Card

INDUSTRIAL OIL PRODUCTS 236
144 Woodbury Rd.
Woodbury, NY 11797
Phone: 516-692-6862
FAX: 516-692-3140

This year Industrial Oil Products features the revival of the domestic tung oil industry. IOP is the exclusive distributor for the American Tung Oil Corp. IOP supplies tung oil and other specialty vegetable oils to the coatings industries.

Circle No. 458 on Reader Service Card

INDUSTRIAL PAINT & POWDER MAGAZINE 132
191 S. Gary Ave.
Carol Stream, IL 60188
Phone: 630-665-1000
FAX: 630-462-2228

Circle No. 459 on Reader Service Card

INMARK, INC. 1243
220 Fisk Dr., SW
Atlanta, GA 30036
Phone: 404-349-4432
FAX: 404-349-5249

UN certified performance packaging for shipping paint, paint related materials, and other hazardous materials are highlighted.

Circle No. 460 on Reader Service Card

INPRA-LATINA 1439
1680 SW Bayshore Blvd.
Port St. Lucie, FL 34984
Phone: 561-879-6666
FAX: 561-879-7388

Circle No. 461 on Reader Service Card

INTELLUTION 2805
One Edgewater Dr.
Norwood, MA 02062
Phone: 617-769-8878
FAX: 617-769-1990

Intellution, a manufacturer of industrial automation software with over 45,000 installations worldwide, provides a full line of products for applications of all sizes, ranging from entry-level MMI to SCADA and MES systems for batch applications. Our newest product, FIX 6 for Windows 95® and NT, is the industry's first true 32-bit automation application.

Circle No. 462 on Reader Service Card

INTERFIBE CORP. 1148
6001 Cochran Rd., A-202
Solon, OH 44139
Phone: 216-248-2266
FAX: 216-248-2132

Interfibe cellulose fibers are characterized by viscosity building & reinforcing qualities. In acrylic systems, Interfibe is incorporated to provide reduced weight & sag resistance.

Circle No. 463 on Reader Service Card

INTERNATIONAL COMPLIANCE CENTER LTD. 2735
2150 Liberty Dr.
Niagara Falls, NY 14304
Phone: 716-283-0002
FAX: 716-283-0119

International Compliance Center Ltd. exhibits products and services to help the industry comply with 49CFR, IATA, IMDG, and Canadian TDG/WHMIS regulations. Products include: labels, placards, packaging, drum labels, bar coding, and forms.

Circle No. 464 on Reader Service Card

INTERNATIONAL SPECIALITY CHEMICALS 2820
500 International Dr., Ste. 120
Mt. Olive, NJ 07828
Phone: 201-426-0123
FAX: 201-426-0423

International Specialty Chemicals manufactures bisomer hydroxy monomer. Our range of specialty monomers include products for latex and waterborne polymers, multifunctional methacrylates for modification of PVC, PMMA, PE, and rubber, and are used in anaerobic adhesives and sealants. A new product, Bisomer PPA6, has recently been launched as a reactive diluent for use in radiation curable formulations. The Allco range of specialty anhydrides, BTDA, PMA, PMDA is also presented.

Circle No. 465 on Reader Service Card

INTERNATIONAL SPECIALTY PRODUCTS 430
1361 Alps Rd.
Wayne, NJ 07470
Phone: 201-628-3825
FAX: 201-628-4117

International Specialty Products' M-Pyrol NMP reduces VOC emission, replaces hazardous solvents, is non-carcinogenic/nonteratogenic, and is easy to use. For pre-formulated coatings removal, ask about new Ship Shape®. Also available: Rapi-Cure® monomers for radiation curing, Surfadone® LPs for pigment dispersion, polymers for waterborne systems to enhance latex rheology, and Gantrez® pigment dispersants for aqueous systems.

Circle No. 466 on Reader Service Card

ITT A-C PUMP/ITT MARLOW 618
1150 Tennessee Ave.
Cincinnati, OH 45229
Phone: 513-482-2500
FAX: 513-482-2569

Pumps for paints and coatings including stall-free, air operated diaphragm pumps with patented oil-less design for contamination-free pumping are featured. Other pumps on display include Lobeline lobe pumps and chemical service pumps.

Circle No. 467 on Reader Service Card

SC JOHNSON POLYMER 2411
1525 Howe St.
Racine, WI 53403
Phone: 800-231-7868
FAX: 800-437-3266

SC Johnson Polymer is exhibiting SGO (solid grade oligomer) technology for high-solids polyols and their RC (rheology controlled) technology for waterborne emulsion coatings. Special feature areas this year include latex polymers for stain removal, tannin block, and concrete sealing applications with excellent early water-resistance capabilities.

Circle No. 468 on Reader Service Card

JOURNAL OF COATINGS TECHNOLOGY 1078
c/o FSCT
492 Norristown Rd.
Blue Bell, PA 19422-2350
Phone: 610-940-0777
FAX: 610-940-0292

With international readers, the JCT is viewed as the link between key person-

nel in the coatings industry and the companies that provide the latest in raw materials, equipment, services and development to coatings manufacturers. Copies of the JCT are on display. Look for new enhancements in 1997!

Circle No. 469 on Reader Service Card

K-T FELDSPAR CORP. 1317
P.O. Box 309
Spruce Pine, NC 28777
Phone: 704-765-9621
FAX: 704-765-6304

K-T Feldspar features its full line of Minspar fillers. The exhibit highlights K-T's new Minspar 10 (6.5 Hegman) along with recently developed Minspar 7. Minspar 3 and 4, the original Feldspar fillers specified by the paint industry since the 1960's, are also featured. Minspar is the filler of choice when non-frosting, low oil absorption, and high durability are required for your formulations. Minspar is readily available for shipment in bulk, 50 lb. bags, and super sacks. Call for a free sample today!

Circle No. 470 on Reader Service Card

KADY INTERNATIONAL 2442
127 Pleasant Hill Rd., P.O. Box 847
Scarborough, ME 04074
Phone: 207-883-4141
FAX: 207-883-8241

Kady International is showing the Kady mill-rotor-stator high speed dispersion mills. With rotor tip speeds of 9,000 feet per minute, the Kady quickly reduces agglomerates to their original particle size. This fast dispersion mill is available batch or continuous, one pint to 3,000 gallons.

Circle No. 471 on Reader Service Card

M.P. KENES, INC. 1540
15638 S. 70th Ct.
Orland Park, IL 60462
Phone: 708-429-5933
FAX: 708-429-6062

Brochures describing engineering services and automation of coatings manufacturing, as well as PCs and program simulators to display a typical system of storage tanks, dispersers and thindown tanks are featured.

Circle No. 472 on Reader Service Card

KENRICH PETROCHEMICALS, INC. .. 741
140 E. 22nd St.
Bayonne, NJ 07002
Phone: 201-823-9000
FAX: 201-823-0691

Kenrich Petrochemicals features Ken-React titanate, zirconate, and aluminate coupling agents for high-solids and water-based anti-corrosive coatings. Also on display are Ken-Stat KS MZ100, a non-blooming, non-moisture dependent, permanent, and transparent antistat based on combined neoalkoxy zirconates and Kenplast diluents for epoxy.

Circle No. 473 on Reader Service Card

KING INDUSTRIES, INC. 823
Science Rd.
Norwalk, CT 06852
Phone: 203-866-5551
FAX: 203-866-1268

King features its eight major product lines used in the formulation of waterborne and high solids coatings including: TAFIGEL™ associative thickeners, K-FLEX® polyester and polyurethane polyols, K-SPERSE® dispersants, NACORR® rust and corrosion inhibitors, NACURE® & K-CURE® acid catalysts, K-KAT® catalysts for 2K urethanes and DISPARLON® thixotropes and rheological additives.

Circle No. 474 on Reader Service Card

KLINE & CO. 232
165 Passaic Ave.
Fairfield, NJ 07004
Phone: 201-227-6262
FAX: 201-227-6291

Kline & Company has served as consultants to the coatings industry for over 30 years. The company's range of consulting services, through its coatings and minerals practices, includes market analyses, competitive intelligence, mergers, acquisitions and partnerships, manufacturing cost analyses, technology commercialization studies, new production assessments, and other related services.

Circle No. 475 on Reader Service Card

KRAFT CHEMICAL CO. 113
1975 N. Hawthorne Ave.
Melrose Park, IL 60160
Phone: 708-345-5200
FAX: 708-345-4005

Representatives from Aspect Minerals, Kärntner Montanindustrie, American Colloid and Industrial Copolymers are on hand to discuss mica, micaceous iron oxide, a specially-modified thixotrope, oxazalidines, epoxy hardeners, and polyurethane dispersions that are available as part of Kraft's line of raw materials for the paint and coatings industry.

Circle No. 476 on Reader Service Card

KROMACHEM INC. 1851
30 Southard Ave.
P.O. Box 744
Farmingdale, NJ 07727
Phone: 908-751-0980
FAX: 908-751-0981

Kromachem Inc. highlights UV curing additives for printing inks, OPV's, paint and wood finishes; Florstab-UV in can stabilizers; Rad-wax pastes; rad-active flow and leveling and dispersing agents; Waxpersions for solvent wood finishes; and Novapint pigment pastes for computerized paint production.

Circle No. 477 on Reader Service Card

KTA-TATOR, INC. 1417
115 Technology Dr.
Pittsburgh, PA 15275
Phone: 412-788-1300
FAX: 412-788-1306

KTA is displaying the latest line of coating inspection instruments and related gages. In addition, information regarding various KTA services is available.

Circle No. 478 on Reader Service Card

LAPORTE/SCP-LAPONITE RHEOLOGICAL ADDITIVES 2635
1212 Church St.
Gonzales, TX 78629
Phone: 210-672-2891
FAX: 210-672-7206

LAPONITE: clear, shear thinning rheological additives suitable for producing thixotropic liquids or gels. Dispersed without high shear, this product can be sprayed giving sag control and mica/metallic orientation properties. Application areas include wood stains, clearcoats, automotive, multicolor, high gloss systems, pigment suspensions.

Circle No. 479 on Reader Service Card

LAQUE CORROSION SERVICES... 2525
Corner Hwy. 76 & Auditorium Cir.
Wrightsville Beach, NC 28480
Phone: 910-256-2271
FAX: 910-256-9816

LaQue offers marine atmospheric exposure testing at Kure Beach, NC, for evaluation of coatings, components, and operating equipment; environmental and corrosion monitoring; consulting for corrosion and materials selection; and failure analysis. Facilities permit testing in two distinct atmospheric environments, natural seawater, and splash and spray zone. Salt-spray testing and testing of materials and coatings in non-marine environments are also available.

Circle No. 480 on Reader Service Card

LAWTER INTERNATIONAL, INC.... 2528
990 Skokie Blvd.
Northbrook, IL 60062
Phone: 847-498-4700
FAX: 847-498-0066

Lawter is highlighting the Reactol™ line of acrylic polyols for solvent, water and powder plus Advantech™ adhesion promoting resin for latex paints. Also featured are many of Lawter's other lines including specialty resins, hydrocarbon resins fluorescent colors, 100% solids alkyds, wax compounds and micronized powders.

Circle No. 481 on Reader Service Card

THE LENETA CO. 217
15 Whitney Rd.
Mahwah, NJ 07430
Phone: 201-847-9300
FAX: 201-848-8833

The Leneta Company is displaying its line of paint test charts and special purpose drawdown applicators for the measurement of hiding power, leveling, and sag resistance. "Release" type black and white charts, calibration scrub test panels, and gradation charts are of special interest. A comprehensive catalog is available for distribution.

Circle No. 482 on Reader Service Card

LIQUID CONTROLS L.L.C. 207
105 Albrecht Dr.
Lake Bluff, IL 60044-9951
Phone: 847-295-1050
FAX: 847-295-1057

Liquid Controls is displaying its full line of positive displacement, electromagnetic and turbine flow meters along with related electronic controllers.

Circle No. 483 on Reader Service Card

LITTLEFORD DAY, INC. 1344
7451 Empire Dr.
Florence, KY 41042
Phone: 606-525-7600
FAX: 606-525-1446

Littleford Day, Inc., is featuring processing equipment including mixers, granulators, agglomerators, vacuum dryers, liquid dispersers, and pressure reactors. We also provide pilot plant and laboratory equipment. We maintain a completely equipped test center to assist our customer in process development and scale-up.

Circle No. 484 on Reader Service Card

LONGVIEW FIBRE CO. 947
6055 E. Washington Blvd.
Los Angeles, CA 90040
Phone: 213-725-6150
FAX: 213-725-6341

Liquiplex® and Drumplex® polyethylene-bag lined paperboard containers allow shippers to transport non-hazardous liquids. The sizes are 55, 220, 275, and 330 gallons. Once the containers are emptied, they can be disposed or recycled as corrugated paper waste. The containers can reduce product waste, and they help assure product quality.

Circle No. 485 on Reader Service Card

THE LUBRIZOL CORP. 1205
29400 Lakeland Blvd.
Wickliffe, OH 44092
Phone: 216-943-4200
FAX: 216-943-9076

Lubrizol features its line of Lanco™ surface modifiers. Lanco surface modifiers enhance slip and improve resistance to abrasion, scratching, marring, and metal marking. Other products featured are: Ircogel® rheology additives, Ircosperse® dispersants, adhesion promoters, and AMPS® monomer.

Circle No. 486 on Reader Service Card

LUCAS MEYER, INC. 1343
765 E. Pythian Ave.
Decatur, IL 62526
Phone: 217-875-3660
FAX: 217-877-5046

Lucas Meyer produces lecithins and phospholipid based specialty products, for use in paints and coatings, inks, industrial releases, and textiles. Featured products include the Leciwet™ range of water-dispersible lecithins, and the Lipotin™ range of standard fluid lecithins. Lucas Meyer will answer questions concerning application, benefit, and availability of these specialty products.

Circle No. 487 on Reader Service Card

LUZENAC AMERICA 1631
9000 E. Nichols Ave., #200
Englewood, CO 80112
Phone: 303-643-0400
FAX: 303-643-0444

Luzenac America offers high quality talcs to the coatings industry. Interested in improved weatherability? ....corrosion resistance? .... overall coatings performance? ....cost reduction? Come by Booth 1631 and let us help solve your coatings problems. Not interested in improving performance? ....stop by anyway and get your free film thickness gauge!

Circle No. 488 on Reader Service Card

3M OCCUPATIONAL HEALTH & SAFETY 1424
Four Westbrook Corporate Center, Ste. 300
Westchester, IL 60154

OH&ESD products—respirators, sorbents, monitors, hearing protection—are exhibited.

Circle No. 489 on Reader Service Card

3M SPECIALTY CHEMICALS DIV. . 1424
3M Center, Bldg. 223-6S-04
St. Paul, MN 55144-1000
Phone: 612-733-9755
FAX: 612-733-1659

3M Specialty Chemicals exhibits 3M™ Fluorad™ fluorochemical surfactants for effective wetting, leveling and flow control for a variety of water-based, solvent-based, and high-solid systems. Use of Fluorad™ surfactants can result in the elimination of surface defects such as cratering, crawling, orange peeling, and picture framing.

Circle No. 490 on Reader Service Card

3M/ZEELAN INDUSTRIES 1424
3M Center, Bldg. 220-8E-04
St. Paul, MN 55144
Phone: 612-737-1751
FAX: 612-737-1764

3M Specialty Additives and Zeelan Industries showcase a range of microsphere capabilities, including fine particle size, high-strength ZEEOSPHERES ceramic microspheres, and low-density SCOTCHLITE glass bubbles. 3M/Zeelan Industries microspheres provide high filler loading, lower viscosity/resin demand, improved flow, and other physical property enhancements.

Circle No. 491 on Reader Service Card

MACBETH 2404
DIV. OF KOLLMORGEN INST. CORP.
405 Little Britain Rd.
New Windsor, NY 12553-6148
Phone: 914-565-7660
FAX: 914-565-0390

Macbeth offers a complete spectrum of color matching, color quality control & process controls systems; lighting booths and luminaries; and Munsell® visual communication products.

Circle No. 492 on Reader Service Card

MALLINCKRODT-TRIMET TECHNICAL PRODUCTS 1049
2409 N. Cedar Crest Blvd.
Allentown, PA 18104
Phone: 610-433-6330
FAX: 610-433-6361

Featured are specialty aliphatic polyols used for high-solids, low VOC coatings & waterborne polyurethanes.

Circle No. 493 on Reader Service Card

MANUFACTURING BUSINESS SYSTEMS 2832
1250 E. Walnut St.
Pasadena, CA 91106
Phone: 818-585-0103
FAX: 818-585-0106

M.B.S. is an installer of BatchMaster for the coatings industry. M.B.S. provides integrated software for all manufacturing, accounting, R&D regulatory requirements. Spanish versions are available.

Circle No. 494 on Reader Service Card

MAPICO, INC. 1544
11116 S. Towne Sq., Ste. 101
St. Louis, MO 63123
Phone: 314-845-2010
FAX: 314-845-3570

Mapico is displaying their range of synthetic iron oxides and zinc and magnesium ferrites particularly suitable for coil and powder coatings.

Circle No. 495 on Reader Service Card

THE McCRONE GROUP 545
850 Pasquinelli Dr.
Westmont, IL 60559
Phone: 630-887-7100
FAX: 630-887-7417

McCrone Associates solves paint technology problems with modern microscopy: defect analysis substrate characterization, raw materials analysis, film/substrate failures, dry film analysis, and expert witness testimony for automotive, construction, packaging, manufacturing, and appliance industries. McCrone Accessories supplies the paint industry with Olympus microscopes, stereo microscopes, Sony video equipment, and a wide range of microscopy equipment and accessories.

Circle No. 496 on Reader Service Card

McWHORTER TECHNOLOGIES, INC. 714
400 East Cottage Pl.
Carpentersville, IL 60110
Phone: 800-323-5605
FAX: 800-275-8809

McWhorter Technologies highlights latexes for interior trim enamels, stain blocking primers, and corrosion resistant DTM applications. In addition, high performance resins for industrial finishes are featured. McWhorter Technologies

offers coating formulators "full service" resources and the solutions for their resin needs.

Circle No. 497 on Reader Service Card

THE MEARL CORP. 849
(now part of Engelhard Corp.)
320 Old Briarcliff Rd.
Briarcliff Manor, NY 10510
Phone: 914-923-8500
FAX: 914-923-9594

The Mearl Corp. is exhibiting Mearlin and Mearlite pearlescent luster pigments, regular and exterior grades for OEM automotive paint finishes, general coatings, and printing inks. Also included are white pearls of varying intensity, interference colors, and nonmetallic, metallic-like grades, and a new line of exterior Mearlin micro pearls.

Circle No. 498 on Reader Service Card

MICHELMAN, INC. 2620
9080 Shell Rd.
Cincinnati, OH 45236
Phone: 513-793-7766
FAX: 513-793-7766

Michelman's representatives are available to discuss how wax emulsions can be used to improve the performance of your water-based coatings. Stop by booth 2620 for copies of the latest literature and be sure to ask about the new line of Michem® Shield.

Circle No. 499 on Reader Service Card

MICRO POWDERS, INC. 1435
580 White Plains Rd.
Tarrytown, NY 10591
Phone: 914-793-4058
FAX: 914-472-7098

Micro Powders, Inc., of Tarrytown, NY, an ISO 9002 certified company, is exhibiting its full line of quality micronized waxes, wax dispersions, and emulsions for use in paints, printing inks, and coatings. New additions to the product range are being introduced, including new grades for use in powder coatings. MPI's staff of sales and technical personnel are available.

Circle No. 500 on Reader Service Card

MICROFLUIDICS INTERNATIONAL CORP. 2527
30 Ossipee Rd.
Newton, MA 02164
Phone: 617-969-5452
FAX: 617-965-1213

The model M-140K Microfluidizer® processor was developed especially for customers who require elevated operating pressure for their fluid processing applications. In addition to its ability to sustain high pressure (up to 40,000 psi), the M-140K, as with all Microfluidizer lab units, is designed for easy scale up to production size volumes. The newly improved M-140K model features operational and maintenance changes as well as the addition of new components as standard parts.

Circle No. 501 on Reader Service Card

MICROMERITICS 1535
One Micromeritics Dr.
Norcross, GA 30093-1877
Phone: 770-662-3633
FAX: 770-662-3696

Micromeritics manufactures automatic analytical instruments that measure the physical characteristics of powders and solids for R&D, QA/QC, production, and process control applications. Characteristics measured include: particle size, surface area, pore volume, pore size and pore size distribution, true density, envelope (bulk) density, chemisorption, and zeta potential.

Circle No. 502 on Reader Service Card

MICROMET INSTRUMENTS, INC. .. 2707
7 Wells Ave.
Newton Centre, MA 02159
Phone: 617-969-5060
FAX: 617-969-5040

Micromet Instruments, Inc. provides dielectric (instrumentation) for characterizing cure properties of paint and coating resin systems. Dielectric measurements monitor changes in viscosity, rate/extent of reaction, and optimal cure state of coatings. The instrumentation characterizes the cure (drying) of the coating from the initial state through final cure state for coatings down to one micron. Diffusion properties can also be monitored.

Circle No. 503 on Reader Service Card

MILWHITE, INC. 1251
7050 Pointwest Dr., Ste. 190
Houston, TX 77024
Phone: 713-881-1200
FAX: 713-861-7717

Milwhite highlights processed specialty minerals: attapulgite, barite, and bentonite for the coatings industry.

Circle No. 504 on Reader Service Card

MINERAL PIGMENTS 2151
7011 Muirkirk
Beltsville, MD 20705
Phone: 301-210-3400
FAX: 301-210-4967

Mineral Pigments manufactures corrosion inhibiting pigments and refines and processes inorganic color pigments, iron oxide and natural earth pigments. PhosGuard® corrosion inhibitors are featured. They contain no lead or chrome and have a small, spherical particle shape for gloss and corrosion protection at low PVC.

Circle No. 505 on Reader Service Card

MING-ZU CHEMICAL INDUSTRIES 505
1578 Barclay Blvd.
Buffalo Grove, IL 60089
Phone: 847-419-1083
FAX: 847-419-1082

Ming-Zu displays metal complex solvent dyes that are available in powder & liquid forms, alcohol soluble dyes, and water mixable dyes.

Circle No. 506 on Reader Service Card

MINIFIBERS, INC. 2800
2923 Boones Creek Rd.
Johnson City, TN 37615
Phone: 423-282-4242
FAX: 423-282-1450

On display are our wide range of Short Stuff® polyethylene, polypropylene and acrylic reinforcing fibers, together with literature and suggested starting formulations. Sales and technical personnel are available.

Circle No. 507 on Reader Service Card

MINOLTA CORP. 216
101 Williams Dr.
Ramsey, NJ 07446
Phone: 201-934-4642
FAX: 201-825-4374

Minolta is exhibiting its color measurement instruments: full line of portable and benchtop spectrophotometers, colorimeters, and lightbooths. Minolta introduces its new SpectraMatch formulation software for Windows™. Also featured are WinShades software and Winconnect Data Transfer, a Windows based utility package, compatible with Excel and Lotus.

Circle No. 508 on Reader Service Card

MISSISSIPPI LIME CO. 2811
7 Alby St.
P.O. Box 2247
Alton, IL 62002-2247
Phone: 618-465-7741
FAX: 618-465-7786

Mississippi Lime provides information on their line of precipitated calcium carbonate (PCC) products. PCC is a low cost TiO_2 extender and cost effective substitute for calcined clay. A new product, Magnum Gloss Milled, for semi-gloss coatings is being introduced.

Circle No. 509 on Reader Service Card

UMR COATINGS INSTITUTE 130
1870 Miner Circle
142 Schrenk Hall
Rolla, MO 65409-0010
Phone: 573-341-4419
FAX: 573-341-4881

The UMR Coatings Institute displays areas of research, academic education, the UMR Coatings Institute web page, the 5th Bridge Congress on Coating Systems for Bridges and Steel Structures, and the Institute's short course program. The Institute highlights its added technologies and research and testing capabilities.

Circle No. 510 on Reader Service Card

MITSUBISHI CHEMICAL 1050
81 Main St.
White Plains, NY 10601
Phone: 914-286-3600
FAX: 914-681-0760

Mitsubishi Chemical features the following chemical compounds: dimethylol butanoic acid (DMBA), 4-hydroxybutyl acrylate (4HBA), methyl acrylate (4-Hydroxymethylcyclohexyl) and diacetone acrylamide (DAAM). MCC's

well-known Polytail (poly-butanediol, a low molecular weight polyolefin polyol, is also highlighted.

Circle No. 511 on Reader Service Card

MODERN PAINT & COATINGS 1950
6151 Powers Ferry Rd., NW
Atlanta, GA 30339-2941
Phone: 770-955-2500
FAX: 770-955-0400

Complimentary copies of the October Show issue are being distributed from our booth. *Paint Red Book* is also on display.

Circle No. 512 on Reader Service Card

MONSANTO CO. 2235
800 N. Lindbergh Blvd.
St. Louis, MO 63167
Phone: 314-694-5100
FAX: 314-694-4128

Monsanto introduces its line of Resimene® amino crosslinkers for waterborne applications and its new Modaflow® AQ product for waterborne coatings. Also displayed are Santosol® line of environmentally friendly solvents and Monsanto's new web site.

Circle No. 513 on Reader Service Card

MOREHOUSE-COWLES 2047
1400 Kalamazoo St.
South Haven, MI 49090
Phone: 616-637-2128
FAX: 616-637-3421

Now that the merger between Epworth and Morehouse-COWLES is complete, they display two separate models of the "zinger" horizontal media mill with its rotor and chamber design, the "Viscomax" multi-shaft disperser, the new "Cowles" dissolver, and various accessories used in the coatings industry.

Circle No. 514 on Reader Service Card

MORTON INTERNATIONAL 2223
100 N. Riverside Plaza
Chicago, IL 60606
Phone: 312-807-2000
FAX: 312-807-2010

Morton Universal Color Dispersions features UCD® E-Line™, a new water-based, HAPs-free, zero VOC dispersion available in 28 pigments. Their five other dispersion lines and a wide range of acrylic and polyester resins offer a complete service to paint formulators. Morton Waterbased Polymers features Mor-Flo® 1725, a new acrylic copolymer emulsion for high-gloss architectural and industrial coating applications. Mor-Lok® 1043 is highlighted as a sole resin system in formulations of stain resistant flat wall paints.

Circle No. 515 on Reader Service Card

MUETEK ANALYTIC, INC. 1145
2141 Kingston Ct., #114
Marietta, GA 30067
Phone: 770-612-0606
FAX: 770-955-2383

Muetek Analytic's new Penetration Dynamics Analyzer (PDA) measures the penetration behavior of liquids (coatings, inks, oils, water) into paper or other substrates. The Particle Charge Detector, PCD 03 –pH, is the newest development for measuring particle charges and zeta-potential.

Circle No. 516 on Reader Service Card

MYERS ENGINEERING 1128
8376 Salt Lake Ave.
Bell, CA 90201
Phone: 213-560-4723
FAX: 213-771-7789

Myers has a machine display along with technical personnel to assist in solving your dispersing problems.

Circle No. 517 on Reader Service Card

NACAN PRODUCTS LTD. 1235
60 West Dr.
Brampton, Ont., L6T 4W7
Canada
Phone: 905-454-4466
FAX: 905-454-3401

Nacan Products Limited is featuring its line of water-based polymers for solvent-free low odor paints. The Vinamul ethylene vinyl acetate technology provides performance in low odor solvent-free paint formulae superior to conventional coalesced paints. Advancements to the Vinamul technology to meet the changing requirements of the North American market place are featured. Nacan's full range of acrylic and vinyl acrylic polymers are displayed highlighting their benefits to the manufacturer in interior, exterior and specialty applications.

Circle No. 518 on Reader Service Card

NACE INTERNATIONAL 1048
1440 South Creek Dr.
Houston, TX 77084
Phone: 713-492-0535
FAX: 713-859-6694

Since 1943, NACE International has provided the coatings industry with certification, standards, books and journals, conference papers, education programs (including training videos and the internationally recognized Coating Inspector Certification Program), and technical committee information relating to the proper use of protective coatings and linings. With more than 15,000 members worldwide, NACE International is dedicated to corrosion control and coatings technology.

Circle No. 519 on Reader Service Card

NAGASE & CO., LTD. 118
c/o Nagase America Corp.
500 Fifth Ave., Ste. 840
New York, NY 10110
Phone: 212-354-3140
FAX: 212-398-0687

Nagase represents the following raw materials and goods for coatings: Ishihara's special TiO_2 and SnO_2 dispersion for anti-static coatings, Nippon Shokubai's new waterborne oxazoline functional crosslinker, Sekisui Plastics' spherical fine powders for matting and light-diffusion, and Toray's tetragonal toughened zirconia beads as grinding and dispersing media.

Circle No. 520 on Reader Service Card

NAMETRE CO. 2247
101 Liberty St.
Metuchen, NJ 08840
Phone: 908-494-2422
FAX: 908-494-8916

A new version of the Model 300PIC is featured. The 300PIC is an online viscometer that was designed specifically for the paint, ink, and coatings industries. The new version has updated electronics that will be housed in a NEMA4 enclosure. The new 300PIC has a digital display that provides a 4-20mA output and offers options such as temperature measurements, Class I Div1 rating, and a single loop controller.

Circle No. 521 on Reader Service Card

NETZSCH INCORPORATED 204
119 Pickering Way
Exton, PA 19341
Phone: 610-363-8010
FAX: 610-363-0971

Netzsch Incorporated features the Recirculation Mill—Model LMZ25, as well as the newly designed Turbomill—Model TM50. The Turbomill is an enclosed basket mill, particularly suited for small batch processing up to 400 gallons. Also on display is the newly introduced Laboratory Mill—Model LMZO.3.

Circle No. 522 on Reader Service Card

NEUPAK, INC. 1918
3680-A Dodd Rd.
St. Paul, MN 55123
Phone: 612-405-8860
FAX: 612-405-8865

A six head, flush/fill, filling by net weight measurement machine is featured. Machine controls are PC driven, operator interface is via a 14" color monitor. The target weight only need to be entered, all other parameters are calculated and loaded by the PC. As with all Neupak machines the system can be accessed via modem for service. Other volumetric/net weight filling machines are displayed.

Circle No. 523 on Reader Service Card

NEW WAY PACKAGING MACHINERY INC. 1635
210 Blettner Ave.
Hanover, PA 17331
Phone: 717-637-2133
FAX: 717-637-2966

New Way features its E-5 labeler with ELLF label feed, gnome label detector, and hot-melt lap adhesive applicator. Also, a special display for operators of Burt and Standard-Knapp labelers is featured.

Circle No. 524 on Reader Service Card

NICHEM CORP. 2542
600 W. 52nd St.
Chicago, IL 60609
Phone: 312-924-3700
FAX: 312-924-7760

NiChem features acid catalysts, anticorrosive pigments, and UV color dispersions.

Circle No. 525 on Reader Service Card

NORTH AMERICAN PACKAGING CORPORATION (NAMPAC) 543
100 Galleria Pkwy., Ste. 900
Atlanta, GA 30339
Phone: 770-951-4770
FAX: 770-951-4779

NAMPAC supplies containers for the paint and coatings industry. Featured products include our new one gallon all plastic paint can designed to fit existing fill line equipment, full open-head plastic pails, tight head plastic containers, and F-style plastic bottles including barrier treated containers for solvent-based products.

Circle No. 526 on Reader Service Card

NORTH DAKOTA STATE UNIV. 129
54 Dunbar Hall
Fargo, ND 58105
Phone: 701-231-7633
FAX: 701-231-8439

The polymers and coatings education and research programs at the B.S., M.S., and Ph.D levels at North Dakota State University are featured. Detailed information about the university and these programs, as well as the 1997 short courses in coatings science and related topics, are available.

Circle No. 527 on Reader Service Card

NYCO MINERALS, INC. 323
124 Mountain View Dr.
Willsboro, NY 12996
Phone: 518-963-4262
FAX: 518-963-4187

NYCO features new industrial formulations from resin suppliers containing 10 ES Wollastocoat and 10 AS Wollastocoat as cost-effective extenders to corrosion inhibitors. New test data on the use of NYAD 400 and NYAD 1250 to replace micronized talc in powder coatings is available.

Circle No. 528 on Reader Service Card

OHIO POLYCHEMICAL CO. 2708
1920 Leonard Ave.
P.O. Box 369004
Columbus, OH 43219
Phone: 614-253-8511
FAX: 614-253-6327

Ohio Polychemical Company is a manufacturer of compliant resins, monomer modified alkyds, polyesters, phenolics, urethanes, and water reducibles. In addition, OPC operates its own fleet of tankwagons for on-time delivery and has a complete coatings laboratory available for customer research.

Circle No. 529 on Reader Service Card

OLIN CORP. 2435
350 Knotter Dr.
Cheshire, CT 06410
Phone: 203-271-4138
FAX: 203-271-4080

Olin presents two comprehensive product lines for coatings. The Performance Urethanes Division features the Luxate® aliphatic diisocyanates and adducts. The Luxate® product line includes: HDI monomer, IPDI monomer, HDI Trimer, HDI Biuret, and IPDI Trimer. The Biocides Division will showcase its biocides line of specialty fungicides and algaecides for marine and architectural coatings and adhesives.

Circle No. 530 on Reader Service Card

OMEGA RECYCLING TECHNOLOGIES, INC. 1644
5742 Ferrier St.
Montreal, Que., H4P 1M7
Canada
Phone: 514-737-4100
FAX: 514-731-1684

Omega Recycling Technologies is a manufacturer of solvents and oils recycling systems for varied industries include: painting & coatings, printing, industrial plants, hospitals, etc.

Circle No. 531 on Reader Service Card

OMNIMARK INSTRUMENT CORP. 1045
1711 W. University Dr., Ste. 159
Tempe, AZ 85281
Phone: 602-784-2200
FAX: 602-784-4738

Ideally suited for water- or solvent-based paints and coatings, the Mark 2 solids analyzer offers simple one-button operation. The Mark 2 is accurate on the range of solids with complete documentation of results via the internal printer. The new instrument offers simple alphanumeric programming with up to 250 memory slots which can be stored and recalled by name. Free evaluations available, call (800) 835-3211.

Circle No. 532 on Reader Service Card

OSi SPECIALTIES GROUP, INC./ WITCO CORP. 1441
39 Old Ridgebury Rd.
Danbury, CT 06810-5124
Phone: 800-295-2392
FAX: 607-754-7517

Organosilicon-based materials that improve the performance and appearance of coatings are highlighted. Silanes for adhesion promotion and crosslinking, featuring new technology for waterborne systems are also on display. CoatOSil™ and Silwet® additives for COF reduction, mar resistance, flow and leveling, and foam control are presented.

Circle No. 533 on Reader Service Card

OXYCHEM/ OCCIDENTIAL CHEMICAL CORP. 335
5005 LBJ Freeway
P.O. Box 809050
Dallas, TX 75380-9050
Phone: 214-404-4198
FAX: 214-448-6676

OxyChem features Oxsol® 100, a solvent alternative that is VOC exempt, not a hazardous air pollutant, and not an ozone depleter. Oxsol 100 replaces traditional solvents in paints and coatings and provides equivalent or improved performance. OxyChem offers a full product line of pure and blended Oxsol solvents.

Circle No. 534 on Reader Service Card

PAAR PHYSICA USA, INC. 241
1090 King Georges Post Rd., Ste. 407
Edison, NJ 08837
Phone: 908-738-6640
FAX: 908-738-7025

Paar Physica USA Inc. offers a complete line of rheological and process applications.

Circle No. 535 on Reader Service Card

PAINT & COATINGS INDUSTRY 1040
755 W. Big Beaver Rd., Ste. 1000
Troy, MI 48084
Phone: 810-362-3700
FAX: 810-244-6439

Stop by the *Paint & Coatings Industry* booth, and see why *PCI* is a leading publication when it comes to quality editorial, circulation, and ad sales. While there, visit our sales and editorial staff, and pick up your free copy of the latest issue of *PCI*. Ask about our sales bonuses, as well as our Internet site!

Circle No. 536 on Reader Service Card

PAINT RESEARCH ASSOCIATION 1043
8 Waldegrave Rd.
Teddington, Middx. TW11 8LD
England
Phone: 50-44-81-977-4427
FAX: 50-44-81-943-4705

Today PRA is an independent coatings center with a world wide membership and global network of contacts. Core activities at PRA include: research, training, technical services, conferences, consultancy, and publications.

Circle No. 537 on Reader Service Card

PARASOL SYSTEMS, INC. 2716
1851 Craig Rd.
St. Louis, MO 63146
Phone: 314-434-8300
FAX: 314-434-3547

PRO.CHEM is a chemical distribution and manufacturing software solution. Imaging, electronic data interchange, bar coding, specialized labeling, sales force automation, faxing, and scanning are features integrated into the PRO.CHEM accounting, distribution, environmental, and manufacturing modules. PRO.CHEM is integrated with UNIX/

AIX to provide a complete turnkey solution.

Circle No. 538 on Reader Service Card

PARKER HANNIFIN CORP. 1244
PROCESS FILTRATION DIV.
1515 W. South St.
Lebanon, IN 46052
Phone: 317-482-3900
FAX: 317-482-8410

Filtration equipment for the paints, inks, and coatings industry including resin bonded, melt blown, pleated and wound cartridges, and cartridge housings are highlighted. We also manufacture bags and bag housings.

Circle No. 539 on Reader Service Card

PARTICLE SIZING SYSTEMS 2052
75 Aero Camino, Ste. B.
Santa Barbara, CA 93117
Phone: 805-968-1497
FAX: 805-968-0361

Nicomp™ Model 370 submicron particle sizer (0.003 - 5 μm) and AccuSizer Model 770 single particle optical sensing (0.5 - 2500 μm) with modular accessories, including Autodilution^{PAT}, online sensor, zeta potential and dry sample feeder are highlighted. The new AccuSizer 377 provides added capability extending the size range from 3nm to 2500 μm.

Circle No. 540 on Reader Service Card

PENINSULA POLYMERS 1218
9401 Indian Creek Pkwy., Ste. 730
Overland Park, KS 66210
Phone: 913-498-3777
FAX: 913-498-3888

Featured this year is our growing family of functional polymers for use in the coatings industry, including: alkyds, copolymers, polyesters, amino crosslinkers, catalysts, epoxies, reactive diluents, and curing agents.

Circle No. 541 on Reader Service Card

PFAUDLER, INC. 2140
1000 West Ave.
Rochester, NY 14692
Phone: 716-235-1000
FAX: 716-235-3048

Models, photos, and literature for wiped film evaporators used for solvent recovery and polymer devolatilization are highlighted. Photos and literature for complete, agitated reactor systems are displayed.

Circle No. 542 on Reader Service Card

PHENOXY ASSOCIATES 1641
800 Cel River Rd.
Rock Hill, SC 29730
Phone: 803-328-3825
FAX: 803-328-3827

Phenoxy Associates is promoting its entire line of high performance, specialty coating resins with particular emphasis on the more environmentally friendly offerings of its waterborne product and a new, zero VOC candidate, PKHM-85X.

Circle No. 543 on Reader Service Card

PICO CHEMICAL CORP. 2524
400 E. 16th St.
Chicago Heights, IL 60411
Phone: 708-757-4910
FAX: 708-757-4940

Pico, a manufacturer of water-based, specialty chemical cleaning solutions for production, shipping, and storage tank interiors, displays reuseable "workhorse" cleaning products used successfully since 1976.

Circle No. 544 on Reader Service Card

PIONEER PACKAGING
MACHINERY, INC. 2806
135 Farrs Bridge Rd.
P.O. Box 250
Pickens, SC 29671
Phone: 864-878-4999
FAX: 864-878-8642

Pioneer is displaying the Pail Labeler with stationary label magazine and the PR-90 1 gallon and quart labeler for vertical, upright labeling.

Circle No. 545 on Reader Service Card

POLAR MINERALS 332
5060 N. Royal Atlanta Dr.
Tucker, GA 30084
Phone: 770-934-4411
FAX: 770-934-4376

Polar Minerals is exhibiting a wide variety of high purity and high whiteness talcs, calcium carbonates, barytes, and micas. 81.4 and 8101 are 96 brightness, sub-micron calcium carbonates. 1090P is a 96 brightness precipitated barium sulfate that is also sub-micron. Also featured are both high viscosity and low viscosity high brightness talcs.

Circle No. 546 on Reader Service Card

POLY-RESYN, INC. 2423
534 Stevens Ct.
Sleepy Hollow
Dundee, IL 60118
Phone: 847-428-4031
FAX: 847-428-0305

Poly-Resyn, Inc., features Suspeno 201-NBA, an additive designed for high-solids, HAPs free solvent systems, such as industrial and trade sales coatings. Suspeno 201-NBA is a 20% N.V.M. dispersion using n-butyl acetate as the carrier solvent. This product is used for control of anti-sag and anti-settling properties. Also featured are Suspeno 201-X and Suspeno 201-MS anti-settling additives which can also be used in industrial and trade sales coatings.

Circle No. 547 on Reader Service Card

POWDER COATING MAGAZINE 1444
1300 E. 66th St.
Minneapolis, MN 55423
Phone: 612-866-2242
FAX: 612-866-1939

Free subscriptions (and paid foreign subscriptions) are available to the magazine devoted to powder coatings.

Circle No. 548 on Reader Service Card

PPG INDUSTRIES, INC. 523
SPECIALTY CHEMICALS
3938 Porett Dr.
Gurnee, IL 60031
Phone: 847-244-3410
FAX: 847-244-9633

PPG Specialty Chemicals promotes their line of reactive chemicals for the coatings market. Featured products are reactive diluents, monomers, and silicones. Stop by booth #523 and see how PPG reacts to your needs.

Circle No. 549 on Reader Service Card

PQ CORP./POTTERS IND. 423
P.O. Box 840
Valley Forge, PA 19482
Phone: 610-651-4200
FAX: 610-651-4463

PQ and its affiliate, Potters Industries, exhibits functional additives, including Q-Cel®, Extendospheres® and Spherical® hollow spheres for weight reduction and corrosion resistance and Spheriglass® solid spheres for resin extension. Coated products are also available.

Circle No. 550 on Reader Service Card

PRECISION DISPENSING, INC. 2812
905 Airport Rd.
West Chester, PA 19380
Phone: 610-429-4870
FAX: 610-431-3031

Precision Dispensing Incorporated (PDI) manufactures computerized batching systems and software for the measurement and control of color. We manufacture a broad range of products for dispensing, inventory and quality control, as well as lot traceability. Our systems are designed specifically for the paint, coatings, plastics, and ink industries. Stop by our booth to find out how you can lower overall costs and increase your production with computerized batching systems from Precision Dispensing.

Circle No. 551 on Reader Service Card

PREMIER MILL CORP. 1615
One Birchmont Dr.
Reading, PA 19606-3298
Phone: 610-779-9500
FAX: 610-779-9666

Premier Mill Corp. is introducing the new HML-0.20 Laboratory Supermill. In addition, the production size Supermill and Supermill 2 horizontal media mills are available for inspection along with other ancillary processing equipment.

Circle No. 552 on Reader Service Card

PURITY ZINC METALS 2051
290 Arvin Ave.
Stoney Creek, Ont., L8E 2M1
Canada
Phone: 905-662-4802
FAX: 905-664-3944

Purity Zinc displays information on ultra pure grades of zinc dust. Information about various grades of zinc oxide is also available.

Circle No. 553 on Reader Service Card

Q-PANEL LAB PRODUCTS 623
26200 First St.
Cleveland, OH 44145
Phone: 216-835-8700
FAX: 216-835-8738

Q-Panel exhibits the QUV accelerated weathering tester with solar eye irradiance control; the Q-Fog cyclic corrosion tester (CCT); and Q-Lab Weathering Research Service featuring Florida weathering exposures, accelerated weather testing, and cyclic corrosion testing.

Circle No. 554 on Reader Service Card

Q SALES AND LEASING 1548
16720 S. Mozart Ave.
Markham, IL 60426
Phone: 708-331-0094
FAX: 708-331-0096

Q Sales and Leasing provides temperature insulating covers called CargoQuilts to protect temperature sensitive freight. CargoQuilts insulate full truck load, LTL, containers, air cargo and small packages. Protecting water-based resins, adhesives and paints during the winter in dry vans with our CargoQuilts saves money on transportation costs.

Circle No. 555 on Reader Service Card

QUACKENBUSH CO. INC. 240
500 E. Main St.
Lake Zurich, IL 60047
Phone: 847-438-5090
FAX: 847-438-1305

Quackenbush Company and Sigmund Linder jointly offer glass beads for use in making dispersions for the coatings industry. In addition, Quackenbush Company offers milling sand, medium density glass beads, zirconium silicate, and zirconium oxide beads, plus steel shot, chrome steel and ceramic balls, and grinding rods.

Circle No. 556 on Reader Service Card

K.J. QUINN & CO., INC. 747
135 Folly Mill Rd.
Seabrook, NH 03874
Phone: 603-474-7177
FAX: 603-474-9170

K.J. Quinn & Co., Inc., is a manufacturer of liquid polyurethane resins used in coatings and adhesives worldwide. At our booth you will find resins from our product line of OEM product finishes and specialty purpose coatings & adhesives. We are announcing new urethane technology at the Expo.

Circle No. 557 on Reader Service Card

RAABE CORP. 2425
N92 W14701 Anthony Ave.
Menomonee Falls, WI 53051-1630
Phone: 800-966-7580
FAX: 414-255-0684

Raabe is displaying its newly named touch-up paint package line, Precision Color. The product line consists of custom matched touch-up paint available in three paint systems and a variety of applicators. Raabe's newest applicator, the Precision Color Paint Pen, and new paint system, Precision Color High Solids Paint, are also being introduced.

Circle No. 558 on Reader Service Card

RADTECH INTERNATIONAL NORTH AMERICA 128
60 Revere Dr., Ste. 500
Northbrook, IL 60062
Phone: 847-480-9576
FAX: 847-480-9282

RadTech International North America is a not-for-profit association dedicated to fostering technical, scientific, and educational advancement in the manufacture and use of ultraviolet (UV) and electron beam (EB) curable products. Samples of end use applications as well as information on RadTech programs and publications are displayed.

Circle No. 559 on Reader Service Card

RANBAR TECHNOLOGY INC. 1252
1114 Wm. Flinn Hwy.
Glenshaw, PA 15116
Phone: 412-486-1111
FAX: 412-487-3313

Ranbar Technology Inc. manufactures alkyd and polyester resins, specializing in customized formulas. We are highlighting low VOCs, high-solids, and water-reducible resins. Specialty batches of 1500-5000 gallons can be produced. Come visit our Internet demonstration at Booth 1252.

Circle No. 560 on Reader Service Card

REICHHOLD CHEMICALS INC. 804
2400 Ellis Rd.
Research Triangle Park, NC 27709
Phone: 919-990-7500
FAX: 919-990-7711

Reichhold focuses upon the company's expanded capabilities in customer service and features Reichhold's offering of specialty resin technology.

Circle No. 561 on Reader Service Card

RESEARCH TRIANGLE INSTITUTE .. 2443
P.O. Box 12194
Research Triangle Park, NC 27709-2194
Phone: 919-541-6813
FAX: 919-541-7155

Research Triangle Institute provides consulting, testing, training, engineering, environmental, and regulatory services.

Circle No. 562 on Reader Service Card

REXAM MULOX INC. 2829
7592 N.E. Industrial Blvd.
Macon, GA 31206
Phone: 912-784-9040
FAX: 912-784-1179

Featured is the totally groundable "electra" flexible intermediate bulk container (F.I.B.C.). This bag can be used in areas where electrostatic sparks could result in a fire or explosion. Our bags can handle all types of dry flowable products.

Circle No. 563 on Reader Service Card

RHEOX, INC. 400
Wyckoffs Mill Rd.
Hightstown, NJ 08520
Phone: 609-443-2500
FAX: 609-443-2422

Rheox, Inc. is featuring additives for both waterborne, low VOC, and zero VOC systems including the expanded line of rheological additives for solvent, high-solids, and solventless systems. The latest advances in high performance dispersants, slip/leveling agents, and waxes are displayed.

Circle No. 564 on Reader Service Card

RHÔNE-POULENC 2416
CN 7500
Prospect Plains Rd.
Cranbury, NJ 08512
Phone: 609-860-4000
FAX: 609-860-0466

Rhône-Poulenc personnel are available to discuss polyisocyanate resins, water repellents, waterborne water repellents, defoamers, dispersants, metallic crosslinkers, latex polymers, wetting agents and thickeners, metal organics, silicones, monomers, and other technologies. Paints and coatings applications to be discussed include industrial coatings, architectural coatings, concrete, stains, and all types of water-based coatings. Rhone-Poulenc Surfactants has introduced several new ABEX emulsifiers which are "APE" free and give excellent properties to a broad range of latex

polymers. Literature and samples are available.

Circle No. 565 on Reader Service Card

ROHM AND HAAS CO. 211
100 Independence Mall West
Philadelphia, PA 19106
Phone: 215-592-3265
FAX: 215-592-6909

Rohm and Haas supplies binders and additives to the coatings industry.

Circle No. 566 on Reader Service Card

RONNINGEN-PETTER 2624
9151 Shaver Rd.
P.O. Box 188
Portage, MI 49002
Phone: 616-323-1313
FAX: 616-323-0065

Ronningen-Petter DCF series of cleaned-in-place liquid filtration systems are fabricated to remove suspended solids from paints, varnishes, inks, adhesives, and other high-viscosity fluids.The filters are designed to improve the consistency of solids removal and fluid throughput.

Circle No. 567 on Reader Service Card

CHARLES ROSS & SON CO., INC.. 1016
710 Old Willets Path
Hauppauge, NY 11788
Phone: 516-234-0500
FAX: 516-234-0691

Charles Ross provides laboratory and production mixing equipment for wet and dry mixing, blending, dispersing, and grinding. Machinery displayed includes mixers, dispersers, rotor/stators, media mills, ribbon blenders, verticle cone screw blenders, in-line mixer/emulsifiers, and multi-shaft mixers.

Circle No. 568 on Reader Service Card

ROYCE ASSOCIATES 1850
207-215 Avenue L.
Newark, NJ 07105
Phone: 201-465-1302
FAX: 201-465-5190

Royce is a 67 year old chemical manufacturer and supplier of specialty additives, resins and catalysts. Additives: micronized PTFE, polyethylene, polypropylene, EBS, carnuba and other waxes for surface enhancement. Resins: specialty epoxies, curing agents (such as TGIC, phenalkamines), polyesters, high heat resistance (4,4 DDS). Catalysts: sodium formaldehyde sulfoxylate redox agent for polymerization of acrylics and polyvinyl acrylates.

Circle No. 569 on Reader Service Card

RUSSELL FINEX INC. 307
10709 Granite St.
Charlotte, NC 28273
Phone: 704-588-9808
FAX: 704-588-0738

On display are self cleaning filters in 1, 2 and 3 inch sizes, a liquid solid separator for emulsions and coatings, and a 22 inch high speed strainer.

Circle No. 570 on Reader Service Card

SAN ESTERS CORP. 2641
342 Madison Ave., Ste. 710
New York, NY 10173
Phone: 212-972-1112
FAX: 212-972-4625

San Esters is offering a wide variety of methacrylic monomers produced by Mitsubishi Rayon Corp. and specialty acrylic monomers produced by Osaka Organic Chemicals Co., Ltd. Major monomers include glycidyl methacrylate, allyl methacrylate, isobornyl (meth) acrylate, cyclohexyl (meth) acrylate, and 4-hydroxybutyl acrylate.

Circle No. 571 on Reader Service Card

SARTOMER CO., INC. 720
502 Thomas Jones Way
Exton, PA 19341
Phone: 800-SARTOMER
FAX: 610-363-4140

Sartomer Company is exhibiting its specialty chemicals for UV/EB, peroxide and amine-cured applications. In addition, Sartomer presents their photoinitiators, hydrocarbon resins, and phthalocyanine pigment product lines. These products are used in the manufacture of low-VOC coatings, inks, and adhesives.

Circle No. 572 on Reader Service Card

SCHENECTADY INT'L., INC. 2618
2750 Balltown Rd.
Schenectady, NY 12309
Phone: 518-370-4200
FAX: 518-382-8129

Schenectady International manufactures specialty resins for coatings that include alkyds, epoxy esters, polyesters, urethanes, and phenolics. Custom resin production is also available from our plants in Canada, USA, Europe, Pacific Rim, and Far East, supported by development laboratories and comprehensive quality control. Bulk, tote, and drum shipments are serviced. With affiliates around the world, Schenectady International groups provide technical services for local and overseas customers.

Circle No. 573 on Reader Service Card

SCHLUMBERGER MEASUREMENT DIV. 440
1310 Emerald Rd.
Greenwood, SC 29646
Phone: 864-223-1212
FAX: 864-223-0341

Schlumberger Measurement Division manufactures industrial liquids measurement products. Our exhibit features our Coriolis mass flow meter, magnetic flow meters, Intex™ vortex meters, and Neptune® brand positive displacement meters.

Circle No. 574 on Reader Service Card

SCHOLD MACHINE CO. .....
7201 W. 64th Pl.
Chicago, IL 60638
Phone: 708-458-3782
FAX: 708-458-3866

Featured is a variety of processing equipment: horizontal media mill, 100 gallon vertical media mill, inline disperser, vacuum top seal coaxial disperser with rotor stator head, lab top seal coaxial disperser & matching discharge press, 301pVMD high speed disperser & 20lp turbo rotor stator disperser.

Circle No. 575 on Reader Service Card

SEPR CERAMIC BEADS & POWDERS 847
1122 Highway 22
Mountainside, NJ 07092
Phone: 908-654-0660
FAX: 908-654-0669

The BPG department of SEPR manufactures ER120 ceramic beads for grinding & dispersing applications. These electrofused zirconia-silica ceramic beads are used in the manufacture of paints, inks, pigments, minerals, and magnetic coatings.

Circle No. 576 on Reader Service Card

SHAMROCK TECHNOLOGIES INC. . 530
Foot of Pacific St.
Newark, NJ 07114
Phone: 201-242-2999
FAX: 201-242-8074

Shamrock, a manufacturer of micronized PTFE and waxes, is featuring a new line of products for powder coatings and an expanded line of materials for waterborne coatings and inks. Also highlighted at the Expo are new additives for UV coatings.

Circle No. 577 on Reader Service Card

SHELL CHEMICAL CO. 2026
One Shell Plaza
P.O. Box 2463
Houston, TX 77252-2463
Phone: 800-TEC-EPON
FAX: 713-241-6465

Shell features its innovative products and technologies for the coatings industry at the 1996 ICE Show. Products and solutions highlighted include: Epon® and Epi-Rez® waterborne epoxy resins, Epi-Cure® specialty curing agents, Cardura™ glycidyl esters, Veova® vinyl esters, Cypar™ solvents and the Shell BlenPro™ computer blend program, and Kraton Liquid™ polymers.

Circle No. 578 on Reader Service Card

SHERWIN-WILLIAMS CHEMICALS . 525
101 Prospect Ave., N.W.
Cleveland, OH 44145
Phone: 216-566-1294
FAX: 216-566-1876

SWC are exhibiting their line of non-toxic, molybdate-based (MOLY-WHITE®) corrosion inhibitors. Based on twenty years of successful commercial application, molybdates are increasingly recognized as the field-proven alternative to chromate and lead based pigments. Highly cost-effective phosphomolybdate pigment grades are highlighted

Circle No. 579 on Reader Service Card

SILBERLINE MFG. CO., INC. 2407
Lincoln Drive, P.O. Box B
Tamaqua, PA 18252
Phone: 717-688-6050
FAX: 717-688-0197

Silberline displays our family of products including inhibited aluminum pigments for waterborne coatings. Our inhibited pigments are targeted for a variety of aqueous coating systems. The Aquasil™ line of pigments, specifically targeted to the trade & maintenance, and general industrial markets, are chemically treated. We are also displaying additional product lines such as Tufflake™, SSP, LEP, and SilBerTones (colored) aluminum pigments.

Circle No. 580 on Reader Service Card

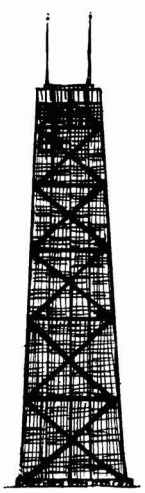
SINGLETON CORP. 1539
3280 W. 67th Pl.
Cleveland, OH 44102
Phone: 216-651-7800
FAX: 216-651-4247

Singleton displays cyclic corrosion equipment for testing coatings under exposure to salt fog, humidity, and variable temperatures.

Circle No. 581 on Reader Service Card

SOFTWARE 2000, INC. 223
25 Communications Way
Drawer 6000
Hyannis, MA 02601
Phone: 508-778-2000
FAX: 508-775-3764

Software 2000 offers a full range of award-winning client/server business applications designed for midrange environments. Their Process Manufacturing solution includes: Advanced Planning; Manufacturing Control; and Formula, Regulatory, and Laboratory Management. Seamless integration with Software 2000's Financial Management, HR/Payroll, and Materials Management applications create a comprehensive Enterprise Resource Planning (ERP) solution for process manufacturing organizations. Visit Software 2000's homepage at http://www.s2k.com.



Circle No. 582 on Reader Service Card

SOLARTON TRANSDUCERS 2835
19408 Park Row, Ste. 320
Houston, TX 77084
Phone: 713-398-7890
FAX: 713-398-7891

Viscosity & density meters, online, continuous measurement. Vibration and rotational instruments utilized by industries such as: petrochemical, pharmaceutical, food & beverage, pulp & paper and coatings.

Circle No. 583 on Reader Service Card

SOUTHERN CLAY PRODUCTS, INC. 1823
1212 Church St.
Gonzales, TX 78629
Phone: 210-672-2891
FAX: 210-672-3650

Southern Clay Products, through technical and commercial partnerships, manufactures specialty additives based on smectite minerals. Smectite based additives created by Southern Clay Products are used in such diverse markets as coatings, paper, ink, cosmetics, plastics, oil field production, pharmaceuticals, lubricants, and homecare.

Circle No. 584 on Reader Service Card

UNIVERSITY OF SOUTHERN MISSISSIPPI 127
Box 10037
Hattiesburg, MS 39406-0037
Phone: 601-266-5618
FAX: 601-266-5880

The USM's Polymer Science Department's focus is its research activities and capabilities. Housed in the Polymer Science Research Center, the Department is fully equipped with such instruments as AFM, ESEM, NMR, DSC/TGA, FTIR, UV, X-Ray, GCMS, GPC, and Camile Control Emulsion Polymerization. Coatings research is enhanced with the traditional coatings lab and a new, fully equipped powder coatings lab. Information will be provided for graduate and undergraduate admission; 1997 International Waterborne, High-Solids, and Powder Coatings Symposium; and the 1997 Coatings Science Short Course Series.

Circle No. 585 on Reader Service Card

SOUTHERN ROYAL MINING CO. .. 1949
18226 McDurmott West, #C
Irvine, CA 92714
Phone: 714-260-0673
FAX: 714-752-6463

Non-metallic minerals for paint and coatings industry are displayed.

Circle No. 586 on Reader Service Card

SPECIALTY MINERALS INC. 635
640 N. 13th St.
Easton, PA 18042-1431
Phone: 610-250-3036
FAX: 610-250-3344

SMI is showcasing its new Summit chlorite product as a TiO_2 optimizer; formulation information is also available. We are promoting our line of low viscosity talcs, LVT series, for waterborne and high-solid coatings.

Circle No. 587 on Reader Service Card

SPENCER MACHINE & TOOL CO., INC. 1948
6205 Gheens Mill Rd.
Jeffersonville, IN 47130
Phone: 812-282-6300
FAX: 812-282-7272

Spencer displays two self-cleaning filtration systems, one 4" and one 2" models.

Circle No. 588 on Reader Service Card

SPRAYMATION, INC. 1142
5320 N.W. 35th Ave.
Fort Lauderdale, FL 33309
Phone: 954-484-9700
FAX: 954-484-9778

Spraymation offers the latest technology in automatic test panel spraying equipment. The 310940 series spray machine features an on-board computer with memory capability to store complete painting sequences. Spray programs can be repeated automatically. All painting variables are controlled for accurate and uniform panel coating applications using liquid or powder. Overlapping or wedge spray patterns are standard. Accurate samples mean accurate test results. CE and GS approved.

Circle No. 589 on Reader Service Card

STARTEX CHEMICAL INC. 2424
2210 Hackberry Ln.
Conroe, TX 77305
Phone: 409-539-6244
FAX: 409-756-1083

Startex offers paint thinners, lacquer thinners, and paint sundry items. Packaging & private labeling of paint related chemicals and solvents are also provided.

Circle No. 590 on Reader Service Card

STEEL STRUCTURES PAINTING COUNCIL 2828
40 24th St., 6th Fl.
Pittsburgh, PA 15222-4643
Phone: 412-281-2331
FAX: 412-281-9992

SSPC, a non-profit technical society and standards organization, is exhibiting recent publications, including *Generic Coating Types*, a new handbook for coatings specifiers, and the revised *Systems and Specifications*. Information on membership, upcoming conferences, training and education opportunities, and the monthly *Journal of Protective Coatings and Linings* is also featured.

Circle No. 591 on Reader Service Card

STRETCH-O-SEAL CORP. 2827
538 S. Euclid Ave.
Oak Park, IL 60304
Phone: 708-445-1900
FAX: 708-448-3797

Stretch-O-Seal features a prototype stretch machine wrapping sample one gallon paint cans to show how machine applied stretch film can eliminate corrugated boxes.

Circle No. 592 on Reader Service Card

SUB-TROPICAL TESTING SERVICE 1840
8290 S.W. 120 St.
Miami, FL 33156
Phone: 305-233-5341
FAX: 305-233-5342

Sub-Tropical Testing Service, located in Miami, FL has technical personnel on hand to discuss natural and accelerated weathering of all types of paint and coatings. Our technical staff has literature available for all types of weather testing at all of our locations throughout the U.S. including our newest specialized site on Blount Island in Jacksonville, FL. Please feel free to come by Booth #1840 to discuss any weathering questions that you might have regarding starting up a new program or advice on bettering your existing test program.

Circle No. 593 on Reader Service Card

SUMMIT PRECISION POLYMERS CORP. 1450
1050 Crestwood Dr.
P.O. Box 99
Mountaintop, PA 18707-0099
Phone: 717-474-9240
FAX: 717-474-9250

Summit Precision Polymers Corporation (SPPC) features descriptions, applications, and photographic representations of our micronized polymer product lines—namely Sumilube 1000 & 2000 series and our SP series of polytetrafluoroethylene (PTFE) additives.

Circle No. 594 on Reader Service Card

SUN CHEMICAL CORP. 835
5020 Spring Grove Ave.
Cincinnati, OH 45232
Phone: 513-681-5950
FAX: 513-632-1537

During this year's Expo, Sun Chemical Corporation demonstrates the use of a new, highly transparent copper phthalocyanine blue, intended for use in "tinted clear coat" formulations by applying the new product to a unique model car.

Circle No. 595 on Reader Service Card

T & S ENT./TAEGER ENTERPRISES . 123
6831 Axelrod Way
Wesley Chapel, FL 33544
Phone: 813-973-3880
FAX: 813-973-2030

Circle No. 596 on Reader Service Card

TA INSTRUMENTS 1451
109 Lukens Dr.
New Castle, DE 19720
Phone: 302-427-4000
FAX: 302-427-4001

TA Instruments supplies thermal analyzers and rheology instruments and related software. A modulated DSC, high resolution TGA and QCR Quality Control Rheometer is displayed.

Circle No. 597 on Reader Service Card

TABER INDUSTRIES 737
455 Bryant St.
N. Tonawanda, NY 14120
Phone: 716-694-4000
FAX: 716-694-1450

Test & measurement instruments including: abrasion resistance testers, stiffness testers, scratch testers, balances, coating thickness gauges, adhesive testers, impact testers, and color and gloss measurement instruments are highlighted.

Circle No. 598 on Reader Service Card

TAOTEK NORTH AMERICA, INC. .. 2630
COROB NORTH AMERICA DIV.
13500 F&G South Point Blvd.
Charlotte, NC 28273
Phone: 704-588-8408
FAX: 704-588-8471

Taotek is a supplier of fully automatic volumetric colorant/paint dispensers and shakers/mixers for both in-store or in-plant applications. Hands-on demonstrations of equipment and software are offered at the booth. Features include simultaneous dispense, high accuracy to a volume of 1/384 fl. oz. +/- 1%, cost-function, statistics, self-diagnostics, and many others.

Circle No. 599 on Reader Service Card

TAYCA CORP. 225
c/o Itochu Spec. Chemicals, Inc.
1751 E. Lincoln Ave.
Madison Heights, MI 48071
Phone: 810-399-0033
FAX: 810-399-1340

Tayca features their K-White line of non-toxic, corrosion inhibiting pigments for use in a variety of paint systems. Highlighted are the newest additions to this line, the 140W which is designed for maximum corrosion protection in aqueous systems and the G105 for use on non-ferrous substrates.

Circle No. 600 on Reader Service Card

TECH PAK, INC. 2042
1751 E. Major Rd.
Custer, MI 49405
Phone: 616-757-2473
FAX: 616-757-2022

Tech Pak offers packaging and unloading systems for packaging bulk bags, bins and totes, with speed & accuracy in a dust free environment. Equipment may be manufactured as stand alone units or as automated systems for high volume requirements. Also on display are baffled and conductive bulk bags and form fit inner liners and stacking storage racks.

Circle No. 60 on Reader Service Card

TEEMARK CORP. 1549
HC 7, Box 14-T
Aitkin, MN 56431
Phone: 800-428-9900
FAX: 218-927-2333

The TeeMark Corporation features CanDoo! crushers that pierce, empty, and crush paint and ink cans. With no need to remove can lids, these units prepare hundreds of cans per hour for recycling or disposal. Paint/ink is collected for reprocessing.

Circle No. 61 on Reader Service Card

TEGO CHEMIE SERVICE 2430
914 E. Randolph Rd.
Hopewell, VA 23860
Phone: 800-446-1809
FAX: 804-541-2783

In keeping with the theme of the 1996 International Coatings Expo, "Insights & Innovations," Tego Chemie Service is reintroducing some products and highlighting new technology. TCS is proud to introduce three new pigment wetting and dispersing additives for water-based systems: TEGO® Dispers 725W, 735W, and 740W. In addition, TCS reintroduces its TEGO® Wet substrate wetting line. TCS presents information on specific products which are suitable for application in UV and EB cured coatings. Finally, stop by to see a demonstration of TEGO® Base, the software product guide and trouble shooting program.

Circle No. 62 on Reader Service Card

THIELE ENGINEERING 1035
7225 Bush Lake Rd.
Minneapolis, MN 55439
Phone: 612-835-2290
FAX: 612-835-5032

Thiele displays a new 5 gallon pump on a 2 head filler with lid placer and press. Also featured is a 2 head top fill machine w/placer & press. Semi-automatic machines are displayed.

Circle No. 63 on Reader Service Card

THOMAS SCIENTIFIC 2427
99 High Hill Rd.
Swedesboro, NJ 08085
Phone: 609-467-2000
FAX: 609-467-3087

Thomas Scientific is a distributor of laboratory instrumentation, equipment, supplies, and chemicals both for general laboratory applications and paints and coatings industry specific applications. Our 2000 page catalog is available.

Circle No. 64 on Reader Service Card

TIKKURILA/KEMIRA 828
One Kemira Rd.
Savannah, GA 31401
Phone: 912-652-1000
FAX: 912-652-1181

Tikkurila exhibits no-VOC colorants, automatic colorant dispensers and high-

speed paint mixers from 1/4 of a gallon to five gallons.

Circle No. 65 on Reader Service Card

TROY CORP. 2400
8 Vreeland Rd.
Florham Park, NJ 07932
Phone: 201-443-0003
FAX: 201-443-0257

An interactive multi-media presentation is the focal point of this booth. The program allows visitors to quickly select information on Troy products of interest and provides within a few seconds an opportunity to see how the products are used in the manufacture of high quality coatings. A highlight of the booth is a new method of controlling algal and fungal growth in coatings by combining the use of algicides and fungicides. The booth also features the complete line of Troy additives for flow and leveling. These products are applicable to waterborne and solvent-borne architectural, industrial, and water-reducible systems.

Circle No. 66 on Reader Service Card

U.S. ALUMINUM, INC. 637
408 Route 202
Flemington, NJ 08822
Phone: 908-782-5454
FAX: 908-782-3489

U.S. Aluminum and Shamrock Aluminum, Waterford, Ireland, affiliates of U.S. Bronze Powders, Inc. introduces its newest aluminum paste product line, Waterfoil. Aquafoil A series bronze paste and Aquafoil B series bronze granules are also being introduced for water-based coatings. Showa Aluminum, Nara, Japan manufacturers of automotive aluminum paste represented by U.S. Aluminum in North America is featured.

Circle No. 67 on Reader Service Card

U.S. BORAX INC. 2623
26877 Tourney Rd.
Valencia, CA 91355-1847
Phone: 805-287-5464
FAX: 805-287-5545

Borogard® ZB is a multi-functional corrosion inhibitor. It can function as a corrosion inhibitor, tannin stain blocker, in-can preservative, and fungicide. Firebrake® ZB is a flame retardant, smoke suppressant, and afterglow suppressant.

Circle No. 68 on Reader Service Card

U.S. SILICA CO. 325
P.O. Box 187
Berkeley Springs, WV 25411
Phone: 304-258-8205
FAX: 304-258-8295

U.S. Silica showcases ground silica, micronized silica, and clay products. MIN-U-SIL®, micronized silica, and SIL-CO-SIL®, ground silica, renders paints and coatings more durable and resistant to chemical attack because of its acid resistance and chemical inertness.

Circle No. 69 on Reader Service Card

U.S. ZINC 2142
6020 Navigation
Houston, TX 77011
Phone: 713-926-1705
FAX: 713-923-1783

U.S. Zinc features a three-panel countertop with pictures of our zinc dust & zinc oxide plant operations. We will have brochures and spec sheets available through our sales staff at the booth.

Circle No. 70 on Reader Service Card

UCB CHEMICALS CORP.
POWDER BUSINESS UNIT 1217
2000 Lake Park Dr.
Smyrna, GA 30080
Phone: 770-801-3241
FAX: 770-801-3200

UCB Chemicals Corp., Powder Business Unit, is a supplier of polyester resins for the powder coating industry. UCB offers a complete range of Crylcoat® and Grilesta® resins and its powder team includes a full technical service staff. Grilesta® is a registered trademark of EMS-Chemie AG, Switzerland.

Circle No. 71 on Reader Service Card

UCB CHEMICALS, INC.
RADCURE 1217
2000 Lake Park Dr.
Smyrna, GA 30080
Phone: 888-723-2873
FAX: 770-434-8314

UCB Chemicals, Inc./Radcure is a supplier of raw materials for UV/EB curing and is part of UCB, SA of Belgium. UCB features a broad range of specialty epoxy, acrylic, urethane, polyester, and amine acrylate Ebecryl® oligomers, monomers, and photoinitiators for the manufacture of low-VOC and highly efficient adhesives, coatings, and inks. UCB has a staff of technical personnel that can be of assistance in your UV/EB curing efforts.

Circle No. 72 on Reader Service Card

UNIMIN SPECIALTY MINERALS 2627
P.O. Box 33, Route 127
Elco, IL 62929-0033
Phone: 618-747-2338
FAX: 618-747-9318

Unimin offers a complete portfolio of mineral fillers and extenders including nepheline syenite, feldspar, microcrystalline silica, ground crystalline silica, and whole grain mineral fillers.

Circle No. 73 on Reader Service Card

UNION CARBIDE CORP. 800
39 Old Ridgebury Rd.
Danbury, CT 06817
Phone: 203-794-3210
FAX: 203-794-3170

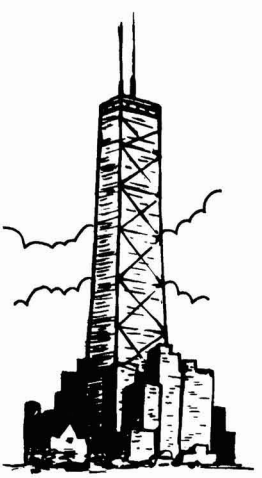
Union Carbide's exhibit features an expanded line of UCAR® solvents and solution vinyl resins for high performance coatings. Cyracure® resins for UV cured coatings, UCAR® acrylics and latexes for trade paints and industrial finishes, cellosize® and UCAR polyphobe thickeners, and coating additives.

Circle No. 74 on Reader Service Card

UNION PROCESS INC. 723
1925 Akron-Peninsula Rd.
Akron, OH 44313
Phone: 330-929-3333
FAX: 330-929-3034

Union Process introduces the HQ10 high speed circulation attritor which joins the Deltamill in providing a choice of either vertical or horizontal small media mills. The HQ10 maximizes the benefits of circulation grinding in a small media mill while the Deltamill maximizes throughput in a single pass. Also on display is the 01-HDDM lab sized small media mill.

Circle No. 75 on Reader Service Card



UNITED MINERAL & CHEMICAL CORP. 2616
1100 Valley Brook Ave.
Lyndhurst, NJ 07071
Phone: 201-507-3300
FAX: 201-507-1506

UMC Corp. displays a full line of phosphorescent pigments including LumiNova®. PANAX organic (dry and presscake) and fluorescent color pigments; and Diroval zinc phosphate anticorrosive and Twinkling Star antimony trioxide flame retardant pigments for the coatings industry are featured. Also displayed are chemical raw materials for coatings such as acrylic monomers, tung oil, and metallic stearates.

Circle No. 76 on Reader Service Card

UNITED SOYBEAN BOARD 2539
c/o Omni International
2715 Ashman St.
Midland, MI 48640
Phone: 517-631-3377
FAX: 517-631-7360

The United Soybean Board (USB) is a farmer based group dedicated to increasing the consumption of U.S. soybeans. One of the ways USB increases demand is funding creative ideas and applications using soybeans in paints and coatings application.

Circle No. 77 on Reader Service Card

VAN WATERS & ROGERS, INC. 1138
600 Hunter Dr., Ste. 300
Oakbrook, IL 60521-1926
Phone: 708-573-4331
FAX: 708-573-2536

Van Waters & Rogers is a distributor of industrial chemicals in the United States and offers chemical products and related services for the paint and coatings industry. Product line includes coalescing aids, glycols, solvents, resins, titanium dioxide, biocides, surfactants, rheology modifiers, and amines.

Circle No. 78 on Reader Service Card

THE VANDEMARK GROUP 1445
One North Transit Rd.
Lockport, NY 14094-1712
Phone: 716-433-6764
FAX: 716-433-2850

The VanDeMark Group is exhibiting information about PTSI, a highly reactive moisture scavenger used to produce urethane-based coatings. PTSI works well when used to manufacture moisture-curing and two-component pigmented systems, as well as sealant and adhesive formulations.

Circle No. 79 on Reader Service Card

R.T. VANDERBILT CO., INC. 2241
30 Winfield St.
Norwalk, CT 06856
Phone: 203-853-1400
FAX: 203-853-1452

R.T. Vanderbilt introduces two new talcs—Nytal 3300 and Nytal 7700. Updated formulation work on Vancor® corrosion inhibitors and Activ-8® in high-solids and water systems is available, as well as information on Vancide®, Nytal®, Pyrax®, and Vantalc®. Technical specialists are staffing the booth to answer questions regarding our entire product line.

Circle No. 80 on Reader Service Card

VERO DISPERSION MACHINES 2444
2120 58th Ave., #124
Vero Beach, FL 32966
Phone: 407-978-0265
FAX: 407-778-9833

Developed to produce low-temperature milling of all types of dispersions, the 'CR Peg Mill produces a fine quality of dispersions, resulting in maximum use of color pigments, etc. The range covers laboratory and production requirements from a 50 ml recycling machine to a 250 liter continuous production unit.

Circle No. 81 on Reader Service Card

VERSA-MATIC PUMP CO. 644
6017 Enterprise Dr.
Export, PA 15632
Phone: 412-327-7867
FAX: 412-327-5234

Versa-Matic's exhibit highlights its Elima-Matic anti-stalling, non-icing, lubrication-free air valve system which virtually eliminates intermittent pump stalling caused by air valve system freeze-ups. Also featured is Versa-Matic's complete line of air-operated, double diaphragm pumps, and replacement parts.

Circle No. 82 on Reader Service Card

VICTAULIC CO. 2737
ENVIRONMENTAL PRODUCTS, INC.
4901 Kesslersville Rd.
Easton, PA 18042
Phone: 610-559-3300
FAX: 610-250-8817

Victaulic features the new Dry Link, dry disconnect hose coupling assembly. This unique product virtually eliminates worker exposure to hazardous fluids during transfer. It is available for 1", 1-1/2", 2" and 3" line sizes.

Circle No. 83 on Reader Service Card

VORTI-SIV DIV. 1028
M M INDUSTRIES, INC.
36135 Salem Grange Rd.
P.O. Box 720
Salem, OH 44460
Phone: 330-332-4958
FAX: 330-332-1543

Shown are several models of our Vorti-Siv line of gyratory sieving & straining equipment, including gyratory and ultra-sonic lab & pilot sieves, along with our complete line of in-line filtration equipment. Applications range from paint & coating filters to media & powder coating sieves.

Circle No. 84 on Reader Service Card

WACKER SILICONES CORP. 1228
3301 Sutton Rd.
Adrian, MI 49221-9397
Phone: 517-264-8500
FAX: 517-264-8620

Wacker provides "silicone solutions" with Addid® paint additives and HDK® fumed silica; high temperature and corrosion resistant, Silres® resins; masonry water repellents including the newest in VOC compliant, water stable technology; and binders, primers, and additives to silicone emulsion paints.

Circle No. 85 on Reader Service Card

WESTERLINS MASKINFABRIK AB . 135
Box 9075
S-20039 Malmö
Sweden
Phone 46 40 21 04 10
FAX: 46 40 22 04 03

Westerlins Maskinfabrik AB features a high speed multi purpose and pilot disperser. Technical information is displayed for the whole range of high speed dissolvers from traditional single shaft, to dual shaft and 3-element dispersers/mixers.

Circle No. 86 on Reader Service Card

WESTERN EQUIPMENT CO. 1047
915 66th Ave.
Oakland, CA 94621
Phone: 510-820-8883
FAX: 510-820-9188

Western Equipment buys, sells, and trades quality used processing and laboratory equipment. Choose from horizontal or vertical media mills, high speed dispersers, tanks, physical test instruments, ovens, balances, gas chromatographs, fork lifts, packaging equipment, and other equipment for the coatings and ink industry. Stop by our booth to discuss your needs and pick up a complete inventory list.

Circle No. 87 on Reader Service Card

WILDEN PUMP & ENG. CO. 1051
22069 Van Buren St.
Grand Terrace, CA 92313-5651
Phone: 909-422-1700
FAX: 909-783-2432

Wilden displays air-operated, double-diaphragm pumps. These positive displacement pumps offer shear sensitive intrinsically safety. New product introductions include: HP 250 high pressure pump, bolted series, and carbon-filled acetal pumps.

Circle No. 88 on Reader Service Card

WITCO CORP. 1647
One American Ln.
Greenwich, CT 06831
Phone: 203-552-2000
FAX: 203-552-2864

Witcobond® aqueous polyurethane dispersions for wood, concrete, metal and other coatings are highlighted. Also featured: Witflow® surfactants, including emulsifiers, anti-floating and anti-flood-

ing agents, pigment dispersants, color acceptance agents, corrosion inhibitors, flow and leveling agents, grinding aids, and latex stabilizers and wetting agents.

Circle No. 89 on Reader Service Card

WORLD MINERALS INC. 516
137 West Central Ave.
P.O. Box 519
Lompoc, CA 93438-0519
Phone: 805-737-2417
FAX: 805-735-5699

World Minerals Inc. line of Celite® and Kenite® diatomites and Micro-Cel® synthetic calcium silicates are featured as flatting agents and extender pigments. A new booth design focuses on the features and benefits for our flatting agents.

Circle No. 90 on Reader Service Card

X-RITE, INC. 227
3100 44th St., S.W.
Grandville, MI 49418
Phone: 616-534-7663
FAX: 616-534-1466

X-Rite features color measurement instrumentation and software for the quality control and color matching needs of paint manufacturers and paint applicators.

Circle No. 91 on Reader Service Card

YAMADA AMERICA, INC. 2724
1575 High Point Dr.
Elgin, IL 60123
Phone: 847-697-1878
FAX: 847-697-2794

Yamada offers eight sizes of air-powered double diaphragm pumps for your liquid transfer needs. Yamada has a large variety of materials of construction and elastomers and features a non-lube, non-stalling air valve.

Circle No. 92 on Reader Service Card

ZACLON, INC. 2706
2981 Independence Rd.
Cleveland, OH 44115
Phone: 216-271-1601
FAX: 216-271-1911

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Regulatory Update October 1996

This digest of current regulatory activity pertinent to the coatings industry is published to inform readers of actions which could affect them and their firms, and is designed to provide sufficient data to enable those interested to seek additional information. Material is supplied by National Paint and Coatings Association, Washington, D.C. The Regulatory Update is made available as a service to FSCT members, to assist them in making independent inquiries about matters of particular interest to them. Although all reasonable steps have been taken to ensure the reliability of the Regulatory Update, the FSCT cannot guarantee its completeness or accuracy.

Environmental Protection Agency
August 27, 1996 - 61 FR 44050
Control Techniques Guidelines for Shipbuilding and Ship Repair Operations (Surface Coatings)
Action: Notice of release of control techniques guidelines (CTG)

The Environmental Protection Agency (EPA) has issued a control technique guideline (CTG) for the control of volatile organic compound (VOC) emissions from surface coating operations in the shipbuilding and ship repair industry. The document is designed to help states in analyzing and determining reasonable available control technology (RACT) for shipbuilding and repair operations in ozone national ambient air quality standards nonattainment areas.

Additionally, this CTG establishes the adoption and implementation dates for RACT. Any state that has not yet adopted an approvable RACT regulation for this source category must submit such a regulation within one year from the date of publication of this notice. States that have already adopted a RACT regulation must now submit revisions to the applicable implementation plan.

For additional information on the CTG, contact Dr. Mohamed Serageldin, EPA, (919) 541-2379.

Environmental Protection Agency
August 14, 1996 - 61 FR 42318
Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Solvents; CERCLA Hazardous Substance Designation and Reportable Quantities
Action: Notice of proposed rulemaking

The Environmental Protection Agency (EPA) is proposing not to add the waste from the use of 14 different solvents to the list of hazardous wastes that are regulated under the Resource Conservation and Recovery Act (RCRA). The determinations in this proposed rule are limited to specific solvent wastes and made pursuant to the current regulatory structure that classifies waste as hazardous either through a specific listing or as defined under hazardous waste characteristics. The chemicals affected include cumene, phenol, isophorone, acetonitrile, furfural, epichlorohydrin, methyl chloride, ethylene dibromide, benzyl chloride, p-dichlorobenzene, 2-methoxyethanol, 2-methoxyethanol acetate, 2-ethoxyethanol acetate, and cyclohexanol.

For further information, contact the RCRA/Superfund Hotline at (800) 424-9346.

Department of Transportation
Federal Highway Administration
August 19 — 61 FR 42822
Federal Motor Carrier Safety Regulations; Intermodal Transportation
Action: Notice; extension of effective date

The Federal Highway Administration (FHWA) has extended the effective date of its final rule, originally published on December 29, 1994, which implements provisions of the Intermodal Safe Container Transportation Act of 1992. This extension is based on petitions and on the inability of the agency to inform many foreign shippers of the rulemaking requirements. The rule, which was scheduled to take effect September 1, 1996, will now be effective January 2, 1997.

For more information, contact FHWA's Peter Chandler, (202) 366-5763, or Charles Medalen, (202) 366-1354.

Environmental Protection Agency
August 26, 1996 - 61 FR 43698
National Emission Standards for Hazardous Air Pollutants (NESHAP) for Source Categories: Organic Hazardous Air Pollutants From the Synthetic Organic Chemical Manufacturing Industry and Other Processes Subject to the Negotiated Regulation for Equipment Leaks; Proposed Rule Clarifications
Action: Proposed rule; Amendments

This notice proposes correcting amendments, in response to petitions, to the National Emission Standards for Hazardous Air Pollutants for Source Categories: Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry (SOCMI) and Other Processes Subject to the Negotiated Regulation for Equipment Leaks regulation. The rule requires new and existing major sources to control emissions of hazardous air pollutants to the maximum achievable control technology level. This rulemaking effects the SOCMI industry, including producers of benzene, toluene, and other specific chemicals.

For additional information, contact EPA's Janet Meyer, (919) 541-5254, Mary Tom Kissell, (919) 541-4516, or Elaine Manning, (919) 541-5499.

Environmental Protection Agency
August 29, 1996 - 61 FR 45778
Lead; Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities
Action: Final rule

The EPA has issued a final rule to ensure the availability of a trained and qualified workforce to identify and address lead-based paint hazards, and to protect the general public from exposure to lead hazards. The regulation,

which went into effect on August 29, 1996, establishes training and certification requirements for anyone performing lead-based paint inspections, risk assessments, and abatement.

Under the regulation, individuals conducting lead-based paint activities in target housing and child-occupied facilities must be properly trained and certified. Training programs must be accredited, and all lead-based paint activities must be conducted according to reliable and safe work practice standards.

For more information, contact Susan Hazen, EPA, (202) 554-0551.

Environmental Protection Agency
September 5, 1996 - 61 FR
National Emission Standards for Hazardous Air Pollutant Emissions (NESHAP): Group I Polymers and Resins
Action: Final rule

As required by section 112 of the Clean Air Act, the EPA is promulgating national emission standards for hazardous air pollutants (NESHAP) from existing and new facilities that emit organic hazardous air pollutants during the manufacture of one or more elastomers. These elastomers are used to produce a number of synthetic rubber products, including adhesives, caulks, seals, and latexes.

Under the standard, emissions limits are established for storage tanks, process vents, equipment leaks, and waste-water systems at facilities that produce elastomers. In addition, the rule specifies criteria for monitoring, recordkeeping, and reporting requirements. Sections on emissions averaging are included in the rulemaking to allow affected facilities more flexibility in meeting emissions limits.

Electronic copies of this regulation are available through EPA's Technology Transfer Network bulletin board, (919) 541-5742. For additional information, contact Robert Rosensteel, EPA, (919) 541-5608.

Environmental Protection Agency
September 9, 1996 — 61 FR 47552
Proposed Guidelines for Ecological Risk Assessment
Action: Notice of availability and opportunity to comment

The EPA has published a document called *Proposed Guidelines for Ecological Risk Assessment* which is designed to help improve the quality of ecological risk assessments at the agency. The guidelines are broad in scope, describing general principles and providing examples to show how risk assessment can be applied to a wide range of systems. The document does not contain detailed information on specific areas.

EPA is accepting comments on the proposed guidelines until December 9. Comments should be sent to EPA, Air and Radiation Docket and Information (6102), Attn: File ORD-ERA-96-01, 401 M Street S.W., Washington DC 20460. Please include one unbound original and three copies. Electronic copies will also be accepted in ASCII format at A-and-R-docket@epamail.epa.gov.

Copies of the document can be obtained on EPA's home page at http://www.epa.gov/ORD/WebPubs/fedreg. For further information, contact Bill van der Schalie, EPA, (202) 260-4191.

Environmental Protection Agency
September 11, 1996 - 61 FR 47840
Recordkeeping and Reporting Burden Reduction
Action: Proposed revisions to rules

As part of a government-wide initiative to eliminate unnecessary standards, the Environmental Protection Agency (EPA) has proposed revisions to recordkeeping and reporting requirements for specific air quality regulations. The agency believes these amendments would reduce the regulatory burden by one million hours a year.

Among other things, the proposal would change the reporting requirements for new source performance standards and national emission standards for hazardous air pollutants from quarterly to semi-annually. Electronic data submission of notifications and reports would be permitted, and sources would be allowed to reduce the number of records maintained to demonstrate compliance.

For additional information, contact David Markwordt, EPA, (919) 541-0837.

Lead-Based Paint Disclosure Guide Available—On March 6, 1996, the EPA and Department of Housing and Urban Development issued a final regulation (61 FR 9064) which requires persons selling or leasing most residential housing built prior to 1978 to disclose the presence of lead-based paint hazards and to provide purchasers with lead hazard information brochure. To help the regulated community comply with the new regulation, the two agencies have developed a guidance document entitled "Interpretive Guidance for the Real Estate Community for the Requirements for Disclosure of Information Concerning Lead-Based Paint in Housing." This document can be obtained over the Internet at EPA's Lead Program home page, located at http://www.epa.gov/docs/lead_wh.html.

President Introduces Pollution Prevention Initiative—On August 28, President Clinton introduced a new environmental initiative designed to encourage pollution prevention and clean up waste sites. The proposal was announced during the Democratic National Convention in an effort to highlight the differences between the two parties' view of environmental protection. It includes reforms in areas such as Superfund, Community Right-to-Know, and environmental crimes. The costs of these plans, which would be funded only through the year 2000, would be offset by new proposed taxes and fees.

Among other things, the initiative calls for granting an additional $1.3 billion over the next two years to the Superfund program in order to accelerate cleanup of hazardous waste sites, and would give federal agencies increased authority to force polluters to clean up sites. President Clinton also asked Congress to reinstate the expired corporate taxes that fund the Superfund program. A bill to reinstate the taxes is currently under consideration by the Senate, but is not widely expected to advance before the end of the session.

President Clinton announced an expansion of the Community Right-to-Know program, giving the public more information on toxic chemicals, but without increasing the regulatory burden on industry. The Environmental Protection Agency will work with state, local and federal agencies to develop a nationwide network to

monitor specific environmental health criteria. Current water quality standards will also be expanded to include at least 75 metropolitan areas. This information will then be made available to the public.

Finally, the initiative proposes legislation to increase the penalties for polluters. The Environmental Crimes Bill would permit the federal government to seize the assets of polluters that dispose of waste illegally even before their conviction. Environmental crimes that result in death or serious injury to the public would be subject to increased penalties, and the statute of limitations on such crimes would be extended. Additionally, environmental criminals would be required to provide restitution to communities affected by their illegal disposal. The proposed bill would also allow the government to prosecute individuals for attempted environmental crimes, rather than being forced to wait for a violation to actually occur.

Vote on Chemical Weapons Treaty Postponed—A planned vote in the Senate to ratify the Chemical Weapons Convention (CWC) treaty was indefinitely postponed on September 12 after last-minute Republican opposition arose over provisions concerning verification and inspection. The treaty, which has been ratified by 63 nations, would prohibit the development, production, manufacture, distribution or use of chemical weapons.

Until recently, the CWC had enjoyed bipartisan support and appeared to be heading for an easy ratification vote. However, concern developed over provisions in the treaty which would require comprehensive inspections of chemical manufacturers and facilities by teams of international inspectors. In addition, questions over whether the verification procedures were effective also arose. As a result, just a few hours before debate on the treaty was scheduled to begin, GOP Presidential candidate Robert Dole urged his colleagues in the Senate to oppose ratification. When it became apparent that the treaty did not have the necessary two-thirds majority for ratification, Senate leaders announced the postponement.

Only two more countries must ratify the CWC in order for it to go into effect. If the Senate does not ratify the treaty, the U.S. would not be able to participate in the development of inspection procedures, and trade restrictions on certain chemicals would be imposed. At presstime, the CWC was not expected to be considered again this session.

States Proposed Legislation and Regulations

ARIZONA

Air Quality (Proposed Regulation)—The Maricopa County (Arizona) Environmental Services Department (ESD) proposed a rule (2 AZAR 3561; 8/9/96) which would amend provisions concerning, among other things, Title V permits, wood furniture coatings, automotive refinishing, new source performance standards, and hazardous air pollutants. Contact Jo Crumbaker, ESD, (602) 506-6705.

A proposed regulation (2 AZAR 3525; 8/9/96) of the Arizona Department of Environmental Quality (DEQ) would incorporate by reference federal updates of new performance standards and national emission standards for hazardous air pollutants. Contact Mark Lewandowski, DEQ, (602) 207-2230.

CALIFORNIA

Air Quality (Proposed Regulation)—A proposal (96 CARR 1523; 8/9/96) of the California Air Resources Board (CARB) would update provisions concerning emission test methods and would add a new test method for determining emissions from stationary sources. Contact George Lew, CARB, (916) 263-1630.

The California CARB has proposed a rule (96 CARR 1526; 8/9/96) concerning the state air toxics hot spots program which would amend the current method for determining fees, would amend criteria for fee exemptions, and would establish fees for specific air districts. Contact Linda Murchison, CARB, (916) 322-6021.

Graffiti—CA A. 2295 (Sweeney and Thompson) authorizes a court to order a person convicted of a graffiti offense to keep the damaged property or another property free of graffiti. On September 9, the bill was sent to the governor.

CA A. 2331 (Goldsmith and Albert) requires the court to suspend the driving privileges of a person convicted of a graffiti offense for one year. The measure was sent to the governor on September 11.

CA A. 2433 (Harvey) increases the maximum fine and community service time imposed on persons convicted of defacing property with graffiti. On September 9, the legislation was sent to the governor for signature.

Hazardous Materials Transportation—CA A. 2201 (House) repeals the provisions requiring the inspection of vehicles used to transport hazardous waste. The bill was sent to the governor on August 20.

Hazardous Waste—CA A. 3474 (Committee on Environmental Safety) deletes the requirement that a material must be recycled within 90 days of its generation. The measure was sent to the governor on September 9.

CA S. 1757 (Calderon) exempts a surface impoundment constructed before July 1, 1986 from the land disposal restrictions for hazardous waste under the federal Resource Conservation and Recovery Act (RCRA). The bill was sent to the governor for signature on August 29.

Lead—CA A. 1195 (Morrissey) requires the adoption of regulations that exempt employers with a *de minimis* amount of lead use from payment of specific fees. The legislation was sent to the governor for signature on September 9.

Pollution Prevention—CA A. 1943 (Bordonaro) permits any state environmental agency to adopt procedures to precertify that equipment or processes comply with pollution control requirements. The governor signed the bill on August 20.

COLORADO

Air Quality (Regulation)—The Colorado Air Quality Control

Commission (AQCC) adopted a final rule (19 COR 2; 8/10/96) which specifies that permits issued by the U.S. EPA under Parts C or D of the Clean Air Act are considered applicable for the state operating permit program. The regulation went into effect August 30. Contact AQCC, (303) 692-3100.

A final regulation (19 COR 2; 8/10/96) of the Colorado AQCC adopts by reference federal new source performance standards, affecting the determination of density, volatile matter content, volume and weight solids, and water content of surface coatings. The rule was effective August 30. Contact AQCC, (303) 692-3100.

GEORGIA

Air Quality (Notice)—The Georgia Department of Natural Resources (DNR) has issued a guidance document on Title V applications containing information on air quality provisions, permit by rule, and synthetic minor sources. Contact DNR, (404) 363-7022.

Air Quality (Regulation)—A final rule adopted by the Georgia DNR incorporates federal amendments concerning prevention of significant deterioration, new sources performance standards, and hazardous air pollutants emissions. In addition, the rule clarifies permit exemptions, updates permit fee provisions, and specifies a list of insignificant activities under Title V operating permits. The regulation was effective June 29. Contact DNR, (404) 363-7028.

Community Right-to-Know (Notice)— The Georgia DNR issued a notice which amends hazardous substances reporting fees for 1996, including facilities that report under the Superfund Amendments and Reauthorization Act (SARA) Title III. The revisions do not affect fees that were due July 1, 1996. Contact Bert Langley, DNR, (404) 656-6905.

Lead (Regulation)—A final regulation of the Georgia DNR establishes procedures and standards for the accreditation of lead-based paint activities and implements requirements for the certification of individuals involved in such activities. Additionally, the rule mandates that all lead hazard activities occurring in target housing or child-occupied facilities must be performed by certified personnel. Contact John Taylor, DNR, (404) 362-2692.

Water Quality (Regulation)—An emergency rule of the Georgia DNR allows the state to issue national pollution discharge elimination system permits, and amends permit requirements for land disposal and storm water. The regulation was effective May 24. Contact DNR, (404) 656-4708.

IDAHO

Air Quality (Regulation)—The Idaho Department of Health and Welfare (DHW) introduced a temporary rule (1996 IDAB 63; 8/7/96) which incorporates applicable maximum achievable control technology standards and removes acetone and methyl siloxanes from the definition of volatile organic compounds. The regulation was effective July 1, 1996 and will become final on July 1, 1997, unless modified before that time by the state legislature. Contact Tim Teater, DHW, (208) 373-0502.

Environmental Audits (Regulation)—A final rule (1996 IDAB 1; 8/7/96) of the Idaho Department of Agriculture (DOA) encourages owners of facilities regulated under environmental laws to conduct voluntary internal environmental audits of their procedures, operations, and programs to assess and improve compliance. Contact Robert Hays, DOA, (208) 332-8605.

Occupational Safety and Health (Proposed Regulation)—A proposed regulation (1996 IDAB 316; 8/7/96) issued by the Idaho Industrial Commission (IC) would update the state's minimum safety and health requirements for personal protection equipment. Contact Mike Poulin, IC, (208) 334-2129.

Toxic Substances (Proposed Regulation)—The Idaho Industrial Commission proposed a regulation (1996 IDAB 849; 8/7/96) which would update the state's minimum safety and health standards concerning toxic and hazardous substances. Contact Mike Poulin, IC, (208) 334-2129.

ILLINOIS

Hazardous Waste (Regulation)—Final regulations (20 ILR 10963, 11078; 8/16/96) of the Illinois Pollution Control Board (PCB) incorporate amendments to federal hazardous waste management requirements, including adding universal waste provisions and postponing the deadline for compliance with organic material emissions standards for tanks, containers, and surface impoundments. The rules became effective August 1. Contact Michael McCambridge, PCB, (312) 814-6924.

INDIANA

Air Quality (Proposed Regulation)—The Indiana Department of Environmental Management (DEM) intends to propose a regulation (19 INR 3219; 8/1/96) which amends the minor new source review permitting program by eliminating specific permit requirements, adding methodology to determine whether a modification to a source occurs, and streamlining the process for modifications that are considered pollution control projects. Contact Rachel Zaffran, DEM, (317) 232-8493.

IOWA

Air Quality (Proposed Regulation)—A proposal (19 IAAB 333; 8/14/96) of the Iowa Department of Natural Resources (DNR) would amend the operating permit standards for small sources; clarify recordkeeping requirements for *de minimis* sources; extend the deadline for permit applications to August 1; and specify that new, small sources have 12 months to obtain an operating permit. Contact Catharine Fitzsimmons, DNR, (515) 281-8941.

Occupational Safety and Health (Proposed Regulation)—The Iowa Division of Labor Services (DLS) proposed a regulation which would incorporate by reference federal Occupational Safety and Health Administration (OSHA) requirements for personal protective equipment for general industry. Contact DLS, (515) 281-3606.

Solid Waste (Regulation)—An emergency regulation of the Iowa DNR establishes a technical advisory committee which will implement cleanup requirements for releases of substances from underground storage tanks. The

rule was effective August 15. Contact Keith Bridson, DNR, (515) 281-8135.

KANSAS

Air Quality (Proposed Regulation)—The Kansas Department of Health and Environment (DHE) intends to develop (15 KSR 1171; 8/1/96) an air quality general Class I operating permit for facilities that have a potential to emit one or more regulated pollutants above major source thresholds but have actual emissions below 50% of that level. Contact Ralph Walden, DHE, (913) 296-1583.

LOUISIANA

Toxic Substances (Proposed Regulation)—A proposal issued by the Louisiana Department of Environmental Quality (DEQ) would incorporate by reference federal standards concerning the chemical accident prevention program, including what facilities must do to minimize risks, would clarify the registration schedules for stationary sources and would add a new list of chemicals to be considered. Contact Patsy Deaville, DEQ, (504) 765-0399.

Air Quality (Proposed Regulation)—A proposed regulation of the Louisiana DEQ would change the frequency for reporting fugitive emissions to semi-annually; and would permit components that seem to be leaking on the basis of sight, sound, or smell to be monitored before being repaired. Contact Patsy Deaville, DEQ, (504) 765-0399.

Air Quality (Notice)—The Louisiana DEQ has issued a report on state air quality for 1995. The report includes information on the state toxic air pollutant emission control program and on ozone standard attainment. Contact Joyce Coleman, DEQ, (504) 765-0902.

MARYLAND

Lead (Regulation)—The Maryland Department of the Environment (DOE) has adopted final regulations (23 MDR 1176-8; 8/2/96) which, among other things, (1) set up standards and procedures for lead paint abatement services; (2) establish requirements for the maintenance and inspection of residential rental properties where lead paint may be present; and (3) specify criteria for the selection of lead-safe housing for relocation of a person with an elevated blood lead level greater than 25 micrograms per deciliter. The rules became effective August 12. Contact Deanna Miles-Brown, DOE, (410) 631-3173.

Lead (Proposed Regulation)—The Maryland Department of Housing and Community Development (DHCD) proposed a regulation which would establish policy and procedures for making grants and loans to owners of residential property or child care centers to fund lead hazard reduction activities. Contact Vance Morris, DHCD, (410) 514-7565.

Occupational Safety and Health (Proposed Regulation)—A proposed regulation of the Maryland Division of Labor and Industry (DLI) would clarify that it is the employer's responsibility to ensure that each affected employee wears protective equipment of the eyes, face, head, and feet when exposed to hazards. Contact Commissioner of Labor and Industry, (410) 333-4184.

MINNESOTA

Air Quality (Regulation)—A final rule (21 MNSR 165; 8/5/96) adopted by the Minnesota Pollution Control Agency (PCA) amends air quality requirements, including air emission permit fees and fees for sources with registration permits, permit contents, shutdown and breakdown notification procedures, and emission inventory reporting standards. The regulation was effective August 12. Contact Mike Mondloch, PCA, (612) 297-5847.

Lead (Regulation)—The Minnesota Pollution Control Agency (PCA) adopted a final regulation (21 MNSR 202; 8/12/96) which establishes procedures for the removal of lead-based paint from steel structures using abrasive blasting and other methods. The rule went into effect on August 19. Contact Norma Coleman, PCA, (612) 296-7712.

MONTANA

Air Quality (Proposed Regulation)—A proposal (1996 MTAR 1928; 7/18/96) of the Montana Board of Environmental Review (BER) would increase the fees for air quality operation and permit applications. Contact BER, (406) 444-2544.

NEBRASKA

Air Quality (Regulation)—A final regulation adopted by the Nebraska Department of Environmental Quality (DEQ) updates air quality standards to be consistent with federal Title V programs; exempts sources subject only to provisions of Section 112(r) of the Clean Air Act from permitting requirements; specifies when a significant emission increase requires a construction permit; and allows the state to approve the use of alternative methods for establishing annual emission rates. Contact Jackie Matulka, DEQ, (402) 471-2186.

NEW JERSEY

Environmental Compliance (Notice)—The New Jersey Department of Environmental Protection (DEP) has established a voluntary pilot program (28 NJR 3978; 8/19/96) to help small business comply with environmental standards and requirements and to develop pollution prevention programs. At the request of a business, a compliance inspector will provide on-site assistance concerning hazardous waste and air quality regulations. Contact Peg Hanna, DEP, (609) 984-3285.

Toxic Substances (Proposed Regulation)—The New Jersey DEP proposed a regulation which would delete certain copper compounds that are used as pigments from the Environmental Hazardous Substances List. This list is used for chemical inventory reporting. Contact Kimberly Hunter, DEP, CN 402, Trenton, NJ 08625.

NORTH CAROLINA

Air Quality (Regulation)—The North Carolina Department of Environment, Health and Natural Resources (DEHNR) adopted a final regulation which (1) incorporates federal new source performance and maximum achievable control technology (MACT) standards; (2) adds permit exemptions; (3) modifies case-by-case MACT procedures; and (4) eliminates a requirement for the permitting of facilities at multiple sites. The rule was effective July 1. Contact Dedra Alston, DEHNR, (919) 715-4192.

Lead (Regulation)—A final regulation of the North Carolina DEHNR establishes lead poisoning prevention standards, creates a scale of elevated blood lead level standards, and specifies what information laboratories must submit to the state concerning lead poisoning. The rule went into effect August 1. Contact Dedra Alston, DEHNR, (919) 715-4192.

OHIO

Air Quality (Proposed Regulation)—A proposal issued by the Ohio Environmental Protection Agency (Ohio EPA) would add an exemption to the current list that allows new sources of organic compound emissions to avoid requirements for their control. Contact Tammy Saunders, Ohio EPA, (614) 644-2270.

Hazardous Materials Transportation (Regulation)—The Ohio Public Utilities Commission (PUC) adopted a final rule (1996 OHMR 2795; 6/30/96) which establishes routing designations applicable to the transportation of non-radioactive hazardous materials in quantities requiring placards. The regulation was effective July 1. Contact PUC, (614) 466-3682.

OKLAHOMA

Air Quality (Proposed Regulation)—A proposed regulation of the Oklahoma Department of Environmental Quality (DEQ) would meet promulgate requirements to meet the federal permitting standards for final approval of the state operating permits program, as mandated under Title V of the federal Clean Air Act. Contact Joyce Sheedy, DEQ, (405) 271-5220.

OREGON

Hazardous Materials Transportation (Proposed Regulation)—A proposed regulation (36 ORRB 15; 8/1/96) issued by the Oregon Department of Transportation (DOT) would amend motor carrier safety requirements by applying federal hazardous materials regulations and penalties to individuals who transport or cause to be transported hazardous materials. Contact Brenda Trump, DOT, (503) 945-5278.

PENNSYLVANIA

Hazardous Waste (Proposed Regulation)—A proposed regulation (26 PAB 3801; 8/3/96) of the Pennsylvania Environmental Quality Board (EQB) would incorporate by reference the federal universal waste rule, would revise provisions for program participants and transporters, and would exclude specific hazardous wastes from the quantity determination for small quantity generator status. Contact Leon Kuchinski, EQB, (717) 787-6239.

TEXAS

Air Quality (Regulation)—A proposal (21 TXR 7341; 8/6/96) issued by the Texas Natural Resource Conservation Commission (NRCC) would adopt regulations concerning the exemption of wood furniture coatings operations from preconstruction air quality permitting requirements. Among other things, the rule would simplify control and record-keeping procedures, amend emission limits, and revise the calculation methods. Contact Lisa Evans, NRCC, (512) 239-5885.

A final rule (21 TXR 7559; 8/9/96) of the Texas NRCC allows manufacturers of regulated consumer products to display information on the product container or package that would enable the determination of the VOC limit for the product as an alternative to dating the product. The regulation went into effect August 16. Contact Mike Magee, NRCC, (512) 239-1511.

UTAH

Air Quality (Proposed Regulation)—The Utah Department of Environmental Quality (DEQ) proposed a regulation (96 UTSB 30; 8/1/96) dealing with the approval process for construction and modification of industrial sources of pollution that would amend notification provisions, list exemptions, establish inventory information requirements for emission sources, and revise work time criteria. Contact Jan Miller, DEQ, (801) 536-4042.

Hazardous Materials Transportation (Proposed Regulation)—A regulation proposed by the Utah Department of Transportation (DOT) would, among other things, extend the authority to ship certain liquid hazardous materials in open-head fiber drums that do not meet performance-oriented packaging standards for hazardous materials; and reduce the requirements pertaining to training frequency, incident reporting, and emergency response numbers. Contact Shirleen Hancock or Tammy Scott, DOT, (801) 965-4781.

VIRGINIA

Occupational Safety and Health (Regulation)—A final rule adopted by the Virginia Department of Labor and Industry (DLI) prescribes the use of personal protective equipment for exposure to toxic chemicals generated by cleaning solvents, chemical paint and preservative removers, mechanical paint removers, and painting operations performed within confined spaces. The regulation was effective September 1. Contact Regina Cobb, DLI, (804) 786-0610.

Extent of Solvents and Chemical Oxygen Demand Build-Up in Boothwater Systems Using Waterborne Paint

Sheila F. Kia, Devi N. Rai, and Ronald L. Williams—General Motors Research & Development Center*

The real-time impact of waterborne paint for basecoat on the spray boothwater system was investigated by monitoring the paint spray systems at five automotive assembly plants for periods up to 555 days. The laboratory analyses of the boothwater samples were aimed at evaluating the extent of accumulation of organic material in boothwater. Among the five systems studied, the boothwater average total organic content in terms of chemical oxygen demand (COD) spanned from 3,300 to 16,400 ppm. For systems with a low boothwater replenishment rate and clean water start-up, the boothwater COD showed an almost linear increase with time. Among the systems, the boothwater contained less than 1,000 ppm organic solvents. The boothwater solvents originate primarily from the paint; the contribution from the purge and the cleaning chemicals is small. For all the systems, the solvents in boothwater account for less than 26% of the boothwater COD. The balance of COD is contributed by nonvolatile organics such as paint resins and the organic polymers from the treatment chemicals, which are present in boothwater as fine particles (<0.45 μm).

INTRODUCTION

There are now several automotive assembly plants that use waterborne paint for basecoat. One important consideration in the implementation of the waterborne paint technology in any plant has been the assessment of its impact on the boothwater system, since waterborne paint contains water-soluble organic solvents and readily dispersible resins that can accumulate in the boothwater.[1] In general, the information on the build-up of organic matter in boothwater is required for:

(1) Assessing the impact of boothwater discharge on the wastewater treatment facilities, particularly when there is a strict limit on the total organic matter discharged to the facility.[2]

(2) Determining the effects on chemical treatment of overspray paint and the needs for reoptimization or for change of the treatment program.[1-3] Our recent study[3] has addressed the adverse conditions that may result from the interactions among waterborne paints, purge solvents, and treatment chemicals.

(3) Evaluating the extent of the organic solvents captured in boothwater for the overall calculations of volatile organic compound (VOC) emissions from paint spray booths.[1]

Our studies[1] show that the accumulation of solvents and other organic matter in boothwater with waterborne paint depends on the booth operating processes including air-boothwater contact in spray booths, biodegradation in boothwater, and boothwater replenishment (often referred to as blow down, which is the rate at which the boothwater is replenished with fresh water, e.g., 20 gal/min). Because of these processes, the extent of the organic build-up in boothwater needs to be assessed for individual systems over a long period of time. Through laboratory investigation of the boothwater from five automotive boothwater systems with waterborne paint for basecoat, we have been able to characterize the boothwater composition and to determine the long-term accumulation of total organics, solids, and individual solvents on the boothwater systems. These research findings are essential for assessing the impact of waterborne paint on the boothwater systems operation and on the boothwater discharge to wastewater treatment facilities.

The material in this report is organized in three sections with the Experimental Section describing the spe-

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Table 1—Basecoat Specifications

	A	B	C	E
Density (lbs/gal)	8.7-10.3	8.5-10.0	8.4-10.0	8.4-10.2
Solids (wt%)	35-49	20-44	21-41	—[a]
Water (wt%)	35-52	30-75	45-67	30-70
Organic Solvents (wt%):				
i-Propanol		0-5	0-5	0-5
Methyl ethyl ketone		0-1	0-1	
i-Butanol		0-1	0-1	
n-Butanol	0-5	1-5	0-15	
Methyl propyl ketone		1-5	0-5	
Methyl amyl ketone		0-1	0-5	
Ethylene glycol butyl ether (butyl Cellosolve)	0-1	1-15	1-15	
Aliphatic naphtha	0-5	0-1	0-1	1-10
Aromatic naphtha	0-1	0-1	0-1	
2-Hexoxyethanol (hexyl Cellosolve)	2-10			0-10
Diethylene glycol monobutyl ether (butyl Carbitol)	0-5			3-30
Polypropylene glycol	1-5		0-1	0-5
Dimethyl ethanol amine	0-5	0-1	0-1	
Propylene glycol methyl ether	0-5			
Propylene glycol monopropyl ether	0-2			
N-methyl-2-pyrolidone	0-5			
Resin (wt%):				
Melamine	5-15	1-15	1-15	1-10
Urethane	0-10	1-30	1-30	0-10
Acrylic		0-15		5-30
Ester		0-15		
Epoxy	0-1			

(a) Not listed in the MSDS.

cifics of the experiments including the boothwater systems, sampling, and laboratory analysis methods. The Results Section covers the results on boothwater individual solvents, total solvents, total organics, and dissolved solids. The main points of the study are summarized in the Conclusions Section.

EXPERIMENTAL

Boothwater Systems and Paints

In the five systems studied in this work, only the basecoat was water-based; the clearcoat and the primer surfacer were solvent-based. The overspray from the two paint types was captured in boothwater either in a mixed or a separate system.

—In the mixed system, there is one common boothwater tank (often referred to as a sludge pit) for all coatings. The overspray from all basecoat, clearcoat, and primer coatings are received in one tank, and together are chemically treated for subsequent removal as paint sludge.

—In the separate system, the overspray-laden boothwater from water-based zones (basecoat) and from the solvent-based zones (clearcoat and primer) enter two separate tanks and receive separate chemical treatments.

Determining whether to use a separate or a mixed system for the chemical treatment of waterborne basecoat has always been an important step in the process of waterborne implementation. Our study[2] has shown that the presence of waterborne basecoat does not adversely affect the chemical treatment of solvent-borne clearcoat and primer, provided that the right treatment program is chosen. In the present study, systems A, B, and C were mixed, and D and E were separate. Among the systems, the boothwater capacity varied from 75,000 to 800,000 gal, and the boothwater recirculation rate to the booths ranged from 12,000 to 54,000 gal/min. The composition of paint varied among different paint manufacturers and also from one boothwater system to the next for the same paint manufacturer. This is illustrated in *Tables* 1 and 2, which list the compositions of waterborne basecoat and solvent-borne clearcoat, per material safety data sheets (MSDS) received from the paint manufacturers at the time of this study. The range specified for each entry in *Table* 1 encompasses the ranges given in MSDS for all the basecoat colors used at a particular system.

Boothwater Sampling & Analysis Methods

Boothwater samples (about 200 cm^3 each) were collected at intervals of 8 hr, 12 hr, or several days. *Table* 3 identifies the time period during which we sampled the five systems, and the samples were generally taken from the return line to the booths. The sample analyses included identification and quantification of individual solvents, total solvents, total organic content, and dissolved solids. The measurement methods are summarized in the following with a more complete description given by Kia et al.[1]

The boothwater samples were analyzed for total organic content, as represented by the COD. The COD is a measure of the oxygen equivalent of the oxidizable organic materials present in the sample.[4] The measurements were done using Hach COD[5] reagent pre-dispensed in Pyrex vials (Hach Co., Colorado). In this

Table 2—Clearcoat Specifications

	A[a]		C
	Component 1	Component 2	
Organic Solvents (wt%):			
i-Propanol	1-2	0-1	
n-Butanol			5-15
2-Ethylhexanol			1-5
Methyl isobutyl ketone		20-25	
n-Propoxy propanol	5-10		
Dipropylene glycol methyl ether	5-10		
n-Butyl acetate	1-2	2-5	
Amyl alcohol	5-10		
Oxo hexyl acetate		10-15	
Isostearic acid		2-5	
N,N-Dimethyl-1-aminododecane		2-5	
Xylene	15-20		1-5
Ethyl benzene			0-1
Cumene			0-1
1,2,4-Trimethyl benzene			1-5
Substituted benzotriazole	2-5		1-5
Aromatic 100 hydrocarbon			15-30
Resins (wt%):			
Melamine	15-20		15-30
Acrylic	20-25		30-50
Epoxy	20-25		
Ester		25-30	

(a) The clearcoat used in system A had two components.

method, 2 cm^3 of the filtered sample (0.45-µm membrane filter) was transferred to the Hach Pyrex vial and refluxed at 150°C in a Hach COD reactor for two hours. The COD of the sample was determined spectrophotometrically in parts per million (ppm).

The organic solvents present in boothwater samples were identified and quantified by a gas chromatography (GC) method that we developed previously.[1] In this analysis, an aliquot (0.4 µL) of the filtered sample (0.45-µm membrane filter) was directly injected into a GC (Perkin Elmer, model 3920B) equipped with a flame ionization detector (FID). External standards were used for calibration.

The boothwater samples from five systems were also analyzed for their dissolved solids content. For this measurement, 25-50 cm^3 of the sample was vacuum filtered (0.45-micron membrane filter). The filtrate was then heated to 105°C for 24 hr and weighed. The sample was further heated to 550°C for four hours and weighed again. Based on the mass losses of the sample at different temperatures, the dissolved solids were determined. Generally, heating to 105°C results in vaporization of water and the volatile organic compounds from the boothwater sample, and heating to 550°C results in destruction of most organic matter. Therefore, the dissolved solids at 105°C represent the total dissolved organic and inorganic solids in boothwater, while the dissolved solids at 550°C measure the inorganic portion. The difference between the two measurements is an indication of the dissolved organic solids in boothwater.

The paint samples were also analyzed for their solvent composition using the GC/FID method.[1] For this analysis, a one percent (by volume) solution of each paint was prepared in deionized water in capped glass bottles. The solution, after being stirred for 16-24 hr, was filtered through a 0.45-µm membrane filter and was directly injected into the GC for solvent analysis.

RESULTS

Individual Solvents in Boothwater

Figure 1 shows typical gas chromatograms of the boothwater at different systems. The GC analysis indicates that the boothwater in the five systems contains a number of organic solvents. The identified solvents include:

- Alcohols: i-propanol, i-butanol, n-butanol, propylene glycol (PG)
- Ketones: methyl ethyl ketone (MEK), methyl propyl ketone (MPK), methyl isobutyl ketone (MIBK)
- Ethers: propylene glycol methyl ether (PGME), propylene glycol propyl ether (PGPE), ethylene glycol butyl ether (butyl Cellosolve), dipropylene glycol methyl ether (DPGME), 2-hexoxyethanol (hexyl Cellosolve), diethylene glycol monobutyl ether (butyl Carbitol)
- Others: N-methyl pyrolidone (NMP), dimethyl ethanol amine (DMEA)

Table 3—Monitoring Period (Days) at Individual Systems

A	B	C	D	E
414	378	368	555	494

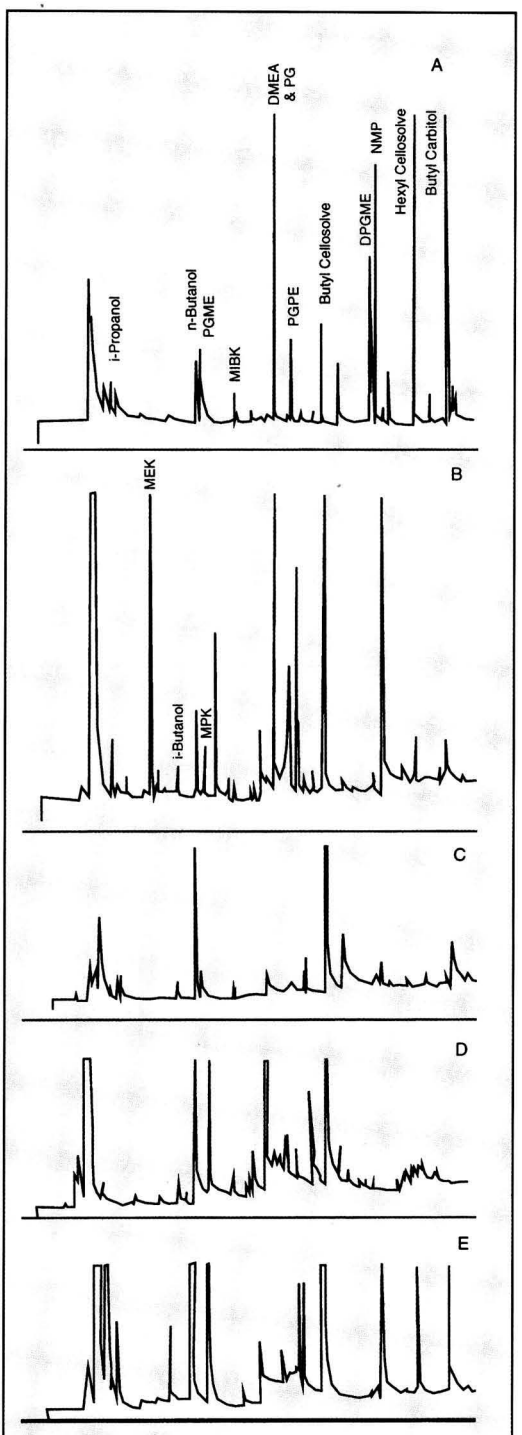

Figure 1—Gas chromatograms of boothwater at five systems.

The variations in concentrations of some of the main solvents identified in boothwater at each system are shown in *Figure* 2 for the period of our monitoring (see *Table* 3). There are discontinuities in the data for systems A and D due to lack of sampling over some periods. The results generally indicate two main points:

(1) For each system, the boothwater concentration of individual solvents varies erratically with time. In system C, for example, the boothwater concentration ranges from 3 to 185 ppm for n-butanol, 5 to 332 ppm for ethylene glycol butyl ether (butyl Cellosolve), and 0 to 112 ppm for diethylene glycol monobutyl ether (butyl Carbitol) (*Figure* 2).

(2) Among the systems, the concentration of a particular solvent in boothwater is not uniform. For example, n-butanol ranges from 9-32 ppm in A, 0-187 ppm in B, and 3-331 ppm in D.

The main solvents in the boothwater at systems B, C, D, and E are i-propanol, n-butanol, ethylene glycol butyl ether (butyl Cellosolve), and diethylene glycol monobutyl ether (butyl Carbitol). These solvents are all common ingredients of the waterborne paint package used in these systems (see *Tables* 1 and 2). However, the solvent package for the waterborne paint in system A is entirely different (see *Tables* 1 and 2), and that is directly reflected in the system boothwater composition; the main solvents in system A are NMP, 2-hexoxyethanol (hexyl Cellosolve), diethylene glycol monobutyl ether (butyl Carbitol), PGME, and DPGME.

The solvents present in the boothwater originate mainly from the paint (both basecoat and clearcoat, see *Tables* 1 and 2). Also, they may be contributed by or originated from the purge, cleaning chemicals, and other materials that enter the boothwater.[1-3] Examples are NMP in system B and i-propanol in A; each of these solvents is a constituent of the purge solvents used in the particular system.

The contribution of the treatment chemicals to the boothwater solvent content is very small since they generally contain none of the main solvents identified in the boothwater systems. *Table* 4 lists the composition of the treatment chemicals used at systems A and B (during most of our monitoring period). It is observed that the treatment chemicals typically consist of organic and inorganic polymers for detackification and flocculation, pH control agents, and defoamers.

Total Solvents in Boothwater

For each system, the total concentration of organic solvents in the boothwater was calculated by summing up the concentrations of the individual solvents that were identified. It is noted that the individual system boothwater may also contain small concentrations of some other solvents, as indicated by the unidentified peaks in *Figure* 1. However, their contributions to the total concentration are expected to be small.

Table 5 lists the average solvent content of boothwater over the monitoring period along with its standard deviation for each system. It is observed that the boothwater solvent content scatters over a wide range for each sys-

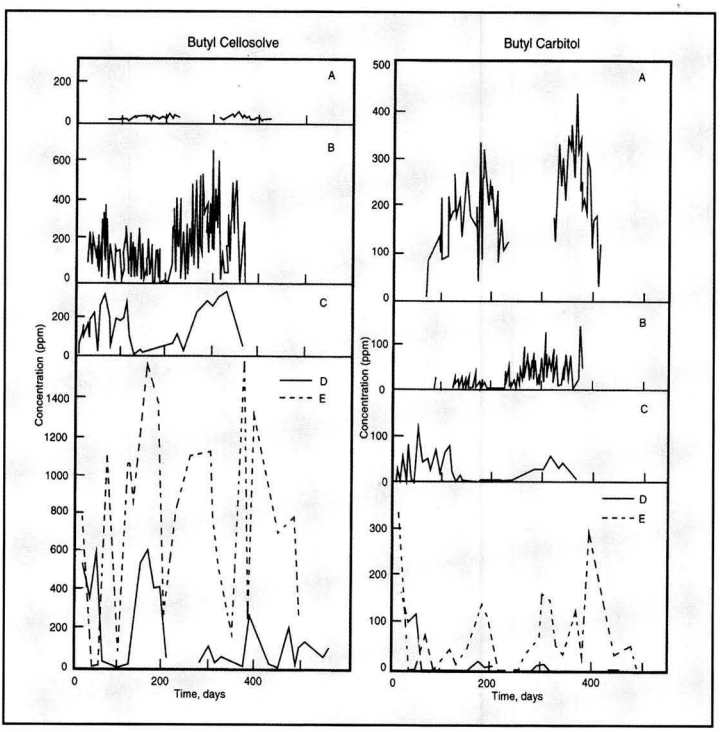

Figure 2—Concentrations of butyl Cellosolve and butyl Carbitol in boothwater at five systems.

tem. For example, the solvent content of boothwater ranges from 27 to 818 ppm for D and from 37 to 422 ppm for C. Among the systems, the boothwater solvent content averages less than 1,000 ppm, with E containing the highest (954 ppm) and C the lowest (226 ppm).

Table 6 gives the distribution of the solvents that were identified in the boothwater at each system. In this table, the numbers represent the average concentrations of individual solvents in wt% based on the total solvents identified for each system. The numbers in parentheses represent the corresponding standard deviations in wt%. For example, MIBK accounts for 0.7% of the total solvents identified in system A. Considering its standard deviation of 0.4%, MIBK concentration is within the 0.3 to 1.1% range.

Table 6 shows that ketones (MEK, MIBK, MPK) in total account for about five percent of the solvents in boothwater for all the systems. More than 95% of the solvents at each of the five systems is accounted by eight solvents: i-propanol, n-butanol, butyl Cellosolve, hexyl Cellosolve, butyl Carbitol, PGME, DPGME, and NMP.

Table 6 shows that the common solvents among the systems are i-propanol, n-butanol, butyl Cellosolve, and butyl Carbitol. These four solvents account for more than 85% of the total solvents present in boothwater at B, C, D, and E. This fraction drops to only 48% at A, with the balance made up by hexyl Cellosolve, PGME, PGPE, DPGME, and NMP.

COD & Dissolved Solids in Boothwater

The total organic content of boothwater measured as COD is shown in *Figure* 3 for each system over the

Table 4—Composition of Treatment Chemicals

	A	B
Detackifiers	1. Silicate salt (<30)[a] Water (>70)	Melamine formaldehyde (<10) Formaldehyde (0.2) Hydrogen chloride (<1.0) Water (>88.8)
	2. Polyquaternary ammonium salt (<35) Polyallyl quaternary ammonium salt (<8) Water (>57)	
Flocculants	Anionic polyacrylamide polymer (>25) Petroleum distillate (>20) Water (<55)	1. Acrylamide cationic polymer (<10) Water (>90) 2. Acylamide nonionic polymer (100)
pH Control		Sodium bicarbonate (99.5) Sodium chloride (<1.0) Sodium sulfate (trace)
Antifoam	Fatty acid mixture (<5) Polyalkylene glycol (<10) Polyalkylene glycol fatty esters (<10) Mineral oil (>75)	Petroleum distillate (85) Distearylamide (<10) Polyalkyl phenol ethoxylate (<5)

(a) Compositions are in wt% per MSDSs.

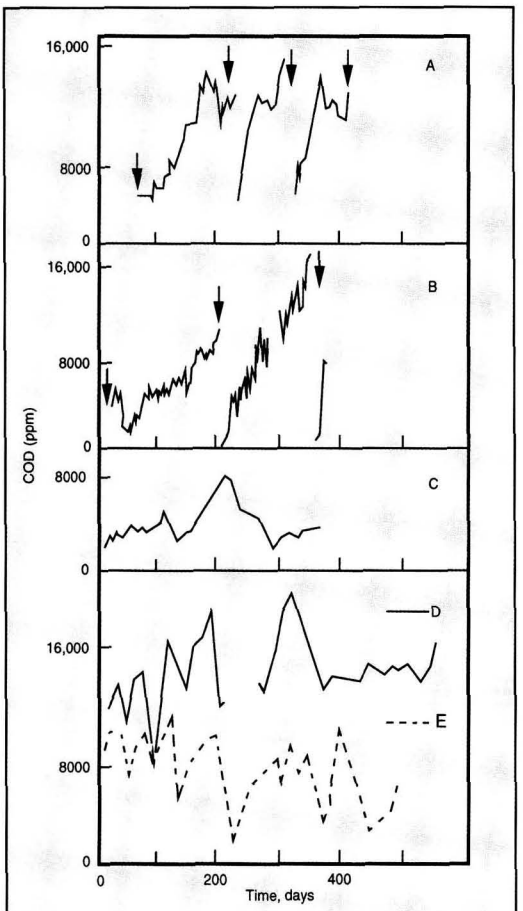

Figure 3—Variations in boothwater COD at five systems.

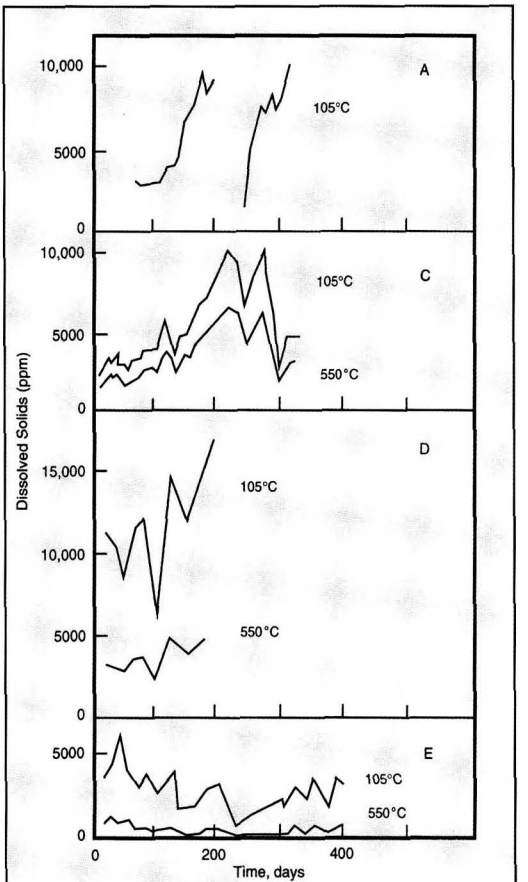

Figure 4—Variations in boothwater dissolved solids at five systems.

period of our monitoring. Over the periods covered in *Figure* 3, systems A and B went through several complete dumpings (clean start-up) where the boothwater tank was completely emptied and refilled with clean water. The boothwater dumping in the other systems was not so well defined since it often involved only partial replenishment of the boothwater with either clean water or the boothwater from the idle tank. The clean start-ups are marked by arrows in *Figure* 3.

Figure 3 shows that the variations in COD are diverse among the systems. The boothwater COD is measured as high as 23,000 ppm for D, in comparison to a maximum of 7,800 ppm for C. The results for A and B show a general trend of increase in COD with time over each clean start-up cycle, while the data for the other systems are scattered. This is mainly because A and B are the only systems over our monitoring periods that went through clean start-up episodes. Starting with clean water in each episode, the boothwater will accumulate organic materials with production time. Meanwhile, the build-up is dampened by the replenishment of boothwater with clean water.[1] The replenishment rate at systems A and B over our monitoring periods was at a low level (about 10,000 gal/day for A and occasionally 5,000-15,000 gal/day for B), therefore the COD build-up almost followed a linear path (see *Figure* 3). This trend is

Table 5—Total Solvents in Boothwater at Five Systems

	A	B	C	D	E
Range, ppm	216-1,005	5-2,015	37-422	27-818	97-1,929
Average, ppm	563	393	226	273	954
Standard Dev., ppm	180	383	122	249	528

Table 6—Distribution of Solvents in Boothwater at Five Systems

	A		B		C		D		E	
	Avg.[a] (wt%)	S.D.[b] (wt%)	Avg. (wt%)	S.D. (wt%)	Avg. (wt%)	S.D. (wt%)	Avg. (wt%)	S.D. (wt%)	Avg. (wt%)	S.D. (wt%)
Solvents:										
MEK	—		0.2	(0.7)	0.3	(0.8)	0.3	(1.0)	—	
MIBK	0.7	(0.4)	—		—		—		—	
MPK	—		0.4	(1.2)	4.0	(4.9)	1.4	(5.2)	0.5	(1.3)
i-Propanol	5.1	(4.9)	3.7	(5.1)	3.9	(3.8)	7.6	(10.5)	4.8	(6.4)
i-Butanol	—		1.0	(0.9)	1.1	(0.8)	2.8	(2.2)	1.4	(3.0)
n-Butanol	3.9	(1.4)	9.1	(15.0)	24.1	(19.6)	29.4	(23.3)	7.9	(13.0)
butyl Cellosolve	3.5	(1.6)	66.9	(26.2)	57.2	(19.8)	55.6	(26.4)	68.8	(22.8)
hexyl Cellosolve	16.2	(5.8	—		—		—		3.0	(1.4)
butyl Carbitol	35.9	(10.8)	5.4	(7.3)	9.4	(8.3)	2.8	(5.4)	8.6	(6.8)
PGME	8.5	(3.7)	—		—		—		—	
PGPE	2.4	(0.8)	—		—		—		—	
DPGME	10.2	(3.6)	—		—		—		—	
NMP	13.9	(6.4)	13.3	(26.5)	—		—		4.9	(7.5)

(a) Average wt% of individual solvents (Ave.) is based on the total solvents identified.
(b) The number in parentheses denotes the standard deviation (S.D).

not manifested in the data for other systems since they mostly experienced no clean start-up and included considerable boothwater replenishments.

The COD in boothwater is contributed by the paint solvents, paint resins, purge solvents, and other organic compounds from the overspray treatment and booth-cleaning chemicals. *Table* 7 lists the contribution to COD by the solvents in boothwater, which was determined from the measured total concentration of solvents in boothwater (*Table* 5) and a conversion factor of 2.2 (1 ppm solvent measures as 2.2 ppm COD). It is observed that the solvents account for 4 to 26% of the boothwater COD among the systems. The remaining 74-96% of the boothwater COD is contributed by the so-called dissolved organic solids (chemically dissolved materials plus the less than 0.45-μm suspended particles). The dissolved organic solids generally include paint resins and the nonvolatile organic compounds from the treatment and booth-cleaning chemicals.[1]

A measure of the organic solids present in the boothwater is given by the difference in the measured dissolved solids at 105°C (total organic and inorganic solids) and 550°C (inorganic solids), as described in the Experimental Section. *Figure* 4 illustrates our limited results on the variations in the boothwater dissolved solids at 105°C with time for A, C, D, and E. Also, *Figure* 4 includes some data on the boothwater dissolved solids at 550°C for C, D, and E. It is observed that the boothwater in each system contains a considerable amount of dissolved solids: up to 6,200 ppm at E, 17,344 ppm at D, 9,920 ppm at C, and 10,200 ppm at A. The difference between the solids at 105°C and 550°C in *Figure* 4 indicates the amount of organic solids in boothwater; as listed in *Table* 7, these organic solids account for 74-96% of the boothwater COD. *Table* 8 lists the average dissolved organic solids, the corresponding average COD, and the ratio of COD to solids for systems C, D, and E. The results show that, among the systems, the COD to solids ratio varies from 1.9 to 2.5 with an average of 2.1, which is close to the average value generally found for solvents (about 2.2). These results indicate that for every 1 ppm increase in the boothwater dissolved organic solids, the COD will increase by 2.1 ppm.

Reasons for the Variability in Boothwater Composition

The results illustrated in *Figures* 2-4 show erratic variations in the boothwater solvents, COD, and solids concentrations with time in each system. To determine the reasons behind these variations, we carried out an intensive sampling of the system C boothwater at a short interval of 8 hr from days 59 to 92. *Figure* 5 shows the boothwater concentrations of n-butanol, butyl Cellosolve, and COD over this period of 5.5 weeks. The Mondays, Wednesdays, and Fridays of the period are labeled by M, W, and F in *Figure* 5.

Figure 5 shows that the variation in the solvent concentration with time is not monotonic, but follows a distinct "zig-zag" pattern. For the most part, the concentration shows an overall increase over the weekdays and declines over the weekends. The reason for this behavior was explained in our previous studies.[1,3] Basically, the changes in solvent concentration correlate with the paint-

Table 7—Distribution of Boothwater COD at Five Systems

	A	B	C	D	E
Boothwater COD, ppm (average)	9,726	5,493	3,336	16,389	8,047
Boothwater solvents, ppm (average)	563	393	226	273	954
Fraction of COD due to solvents (%)	12.7	14.5	14.9	3.7	26.1
Fraction of COD due to dissolved organics (%)	87.3	85.5	85.1	96.3	73.9

Table 8—COD Equivalent of Organic Solids in Boothwater

	C	D	E
Dissolve organic solids, ppm	1,375	8,427	2,385
COD due to dissolved organic solids, ppm	2,839	15,788	5,948
Ratio of COD to organic solids	2.1	1.9	2.5

ing schedule in the spray booths. During painting (production), solvents from the paints are partially captured in the boothwater, resulting in an overall increase in the boothwater solvent content. During the non-painting time, which generally includes the weekends and the third shift, the captured solvents in boothwater continue to be released to the booth air, resulting in an overall decline in the boothwater solvent content. Deviations from this overall trend occur due to the system variability in painting schedule, paint colors and quantity, purging, and the booth cleaning operations. For example, the observed increase in n-butanol or butyl Cellosolve concentration over the last weekend in *Figure* 5 is due to the dumping of the washwater from several paint containers into the boothwater.

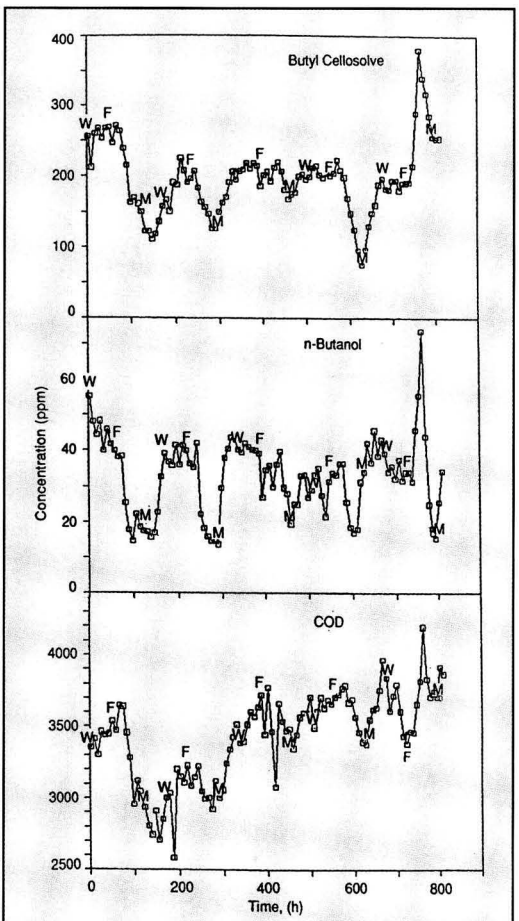

Figure 5—Detailed variations in boothwater COD and solvents (n-butanol and butyl Cellosolve) at system C.

With regard to the boothwater COD (*Figure* 5), the increase over the weekdays is due to the accumulation of organic solvents as well as non-solvent organics (e.g., resins and the organic particles from the treatment chemicals), while the decrease over the weekends is due to the loss of solvents and other organics by evaporating to booth air, boothwater replenishment, leak, or settling of suspended organic particles.

The pattern described previously partly explains the wide variations that exist in the boothwater solvent, COD, and solids concentrations at system C (*Figures* 2-4). In addition, the variations are due to normal changes in production rate, paint usage, paint color and type, overspray rate, purge solvents and cleaning chemicals usage and type, treatment chemicals usage, the extent of paint sludge removal, boothwater replenishment, and make-up water (fresh or from the boothwater in the reserve tank). The differences in the boothwater compositions that exist among the systems are because the systems vary with regard to the materials used in the paint shop and their usage (paint, purge solvents, cleaning material, treatment chemicals), production schedule, overspray rate, boothwater tank capacity, boothwater circulation rate, air-water contact in the booth scrubber, boothwater replenishment rate, leaks, and biological activity in the boothwater.

CONCLUSIONS

Waterborne basecoat results in considerable accumulation of organic matter in the boothwater at all five automotive boothwater systems. The boothwater total organic content in terms of COD spans the range of 3,300-16,400 ppm. Most of the boothwater COD (74-96% among the systems) is contributed by nonvolatile organics, which are present as fine particles and consist mostly of paint resins and organic polymers from the treatment chemicals. These solids, commonly referred to as dissolved solids, are of concern in the treatment of overspray paint and in the discharge of boothwater to wastewater treatment facilities as they do not easily separate out or biologically degrade. Both concerns have to be considered in order to manage the chemical treatment program, boothwater replenishment, and system dumping.

The organic solvents in boothwater account for less than 26% of the boothwater COD for all the systems. Among the systems, the boothwater contains less than 1,000 ppm organic solvents. The solvents in boothwater originate primarily from the paint; the contribution from

the purge, booth-cleaning agents, and treatment chemicals is small.

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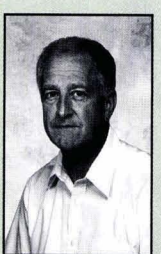

R.L. Williams

Dielectric and Thermal Analysis of the Film Formation of a Polymer Latex

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The real-time kinetics of film formation of a floor polish polymer latex coating has been investigated using dielectric measurements of the ionic conductance. Varying levels of ambient humidity were applied and had a dramatic effect on the drying rate, drying mechanism, and final film thermal and mechanical properties. At humidities below 30%, the drying curves followed a power law time decay with two distinguishable regions. The first region showed a drying rate dependence on the order of t^{-10}, while the second region showed a slower drying rate with a time dependence on the order of t^{-2}. At higher humidities, the curves become more complex. At the highest humidities, film cracking was observed. Besides dielectric analysis, thermal analysis experiments were conducted that indicated film formation continues over very long times (months). The data also indicate that considerable residual stress remains in the dried films even after these long times.

INTRODUCTION

Latex Emulsions and Floor Polish

Because of its ease of application and environmental friendliness, the polymer latex has become a popular alternative to the more traditional solvent-based coatings. The primary feature of a water-based latex is that the polymer is not dissolved in the water, but is instead a colloidal dispersion (or 'emulsion') of polymer particles in an aqueous medium. In this paper a latex formulation, which is representative of floor polish, was studied.

Floor polish is used as a protective coating over wood, tile, or concrete floors. It provides a barrier against water and soil, and extends the life of a floor. Early floor polishes were made of melted beeswax and later with harder waxes dissolved in solvents. Modern floor polishes still have a wax component in their formulation. However, there is now also a large polymer component (often the major component) that is in the form of a water-based emulsion or latex.[1] Because of the variety of applications, there are many different floor polish formulations with varying amounts of polymer and wax. The floor polish chosen for this study is a sealer, containing no wax component. Sealers are used primarily as an undercoat that seals the pores in the flooring surface. When the sealer dries, it forms a relatively hard amorphous film that is impervious to water and many other solvents.

For a latex emulsion to form a continuous film, the latex particles must be soft enough to deform and possibly interdiffuse. The glass transition temperature is a particularly useful parameter for assessing the hardness of the latex polymer. The paint and floor polish industry uses a more empirical parameter, analogous to the glass transition temperature, which is called the minimum film formation temperature (MFT).[2] A common way to manipulate this MFT (so that it is low enough to allow latex particle deformation without lowering the final film hardness) is to decrease the latex T_g with a coalescing solvent. The coalescent acts as a temporary plasticizer. After the film has dried (water evaporated), the coalescing solvent presumably evaporates over time and the film hardens. This is an important factor in the coalescence of the film and should be considered when measuring the coalescence.

A second factor, common in floor polish formulations, is the use of zinc complexes that induce ionic crosslinks to form in the latex film as it dries.[3] Though the exact chemical nature of the crosslink formed is still in question, the macroscopic effect is clearly a hardening of the final film. Another interesting aspect of these ionic crosslinks is that they can be selectively removed with alkaline strippers such as ammonia, which complex with the zinc. The crosslinking adds another variable to the understanding of film formation in a real-world latex

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Table 1—List of Components Used in Model Floor Polish Formulation, UDL01, Before and After Drying

Component	Amount in Latex Mixture	Amount of Non-Volatiles	Estimated Amount in Dried Film
Polymer (30 Styrene/17 MMA/40 IBMA/13 MMA)	54%	33%	84%
Resin (32 Styrene/38 α-Methyl Styrene/30 AA)	5%	20%	5%
Deionized water & NH_4OH (5%)	26%	5%	6%
Carbitol	7%		
Zonyl FSJ fluorocarbon	6%	1%	<1%
Zinc ammonium carbonate solution (15% ZnO)	1%	15%	<1%
Tributoxyethyl phosphate	1%	100%	5%

formulation such as floor polish. Also, when used in real applications, floor polish latexes have other additives that affect their coalescence and their final properties. These additional ingredients must be considered when measuring the coalescence of the film.

Latex Coalescence

When the latex emulsion is applied to a surface, the water evaporates and the latex particles pack together and coalesce. This coalescence may result in a continuous film. However, if the conditions are not favorable, the latex particles do not coalesce properly. Instead they form a powder or a very weak film that cracks. In order for a latex emulsion to be useful as a coating, it must coalesce into a continuous film. An understanding of the mechanism of the coalescence is of practical importance, since the final properties of a coalesced film will determine its performance as a useful polish.

Though there is still some discussion about the details of latex coalescence, the main features are generally agreed upon. There are three main stages in the drying of a latex.[4-14] The first stage, known as the induction stage, occurs when the percentage of water is still high enough so the latex particles are, at best, in point contact with each other and are not yet deformed. Eventually the film formation moves into the second stage in which the latex spheres begin to deform into polygonal units rather than perfect spheres. In this stage, the latex spheres are driven together by the evaporation of interstitial water. The third and final stage occurs when the deformation of the latex particles reaches a plateau and the film undergoes coalescence, which is presumably caused by interdiffusion of polymer chains.[5] However, depending on the type of surfactant molecule used, a membrane structure has been known to form that prevents interdiffusion of the interior latex polymer chains.[6,7]

The second and final stages have the most direct effect on the final properties of the film, since they are where the particle fusion occurs. There have been many theories proposed to describe what is happening during this fusion, but there has not been general agreement. Dillon, Matheson, & Bradford[8] first proposed a dry-sintering model where the particle deformation and fusion occurs after water evaporation. However, most of the theories are based on the wet-sintering concept first proposed by Brown,[4] where capillary forces cause the particle deformation. As the interstitial water evaporates, an increasing capillary pressure forces the particles closer together until the stabilizing layers (i.e., the charged layers surrounding the latex particles) rupture and there is polymer-polymer contact. At the same time a surface tension (actually a polymer/water interfacial tension) further increases the pressure on the particles and causes further flow and fusion of the polymer. An interesting twist to these ideas is given in a theory by Sheetz,[9] who proposes that the capillary forces act on the surface particles first, thus forming an outer layer through which water must diffuse. Eckersley & Rudin[14] more recently proposed a theory that describes some of the concepts of these previous theories in terms of a viscoelastic model where both capillary and interfacial tension forces are considered. With their model, they estimated the amount of deformation of the latex particles after drying and used scanning electron microscopy to verify their calculations. Though their model may be useful for understanding a simple latex formulation, unfortunately most practical applications of latexes include coalescents that complicate the drying mechanisms. For example, Hoy[15] has shown that the coalescent may migrate from the water to the latex as water evaporates from the system.

Measurements Techniques

Of course, a theory is only as good as the experimental evidence that supports it. There are a number of different techniques that have been used to characterize latex film formation in real time. An early example is the mechanical impedance measurement of Myers & Knauss.[13] In their experiments they measured a sample's response to a mechanical pulse as a function of drying time. In a series of papers, Anwari et al.[16] used optical techniques to measure film formation. In particular, they measured the reflectance using a spectrophotometer and studied the effect of such things as particle size, coalescent solvent, and pigment. Sheetz,[9] and more recently Dobler et al.,[17] measured the solids content of a drying film by measuring the weight loss as water evaporated.

In addition, many techniques have been used to characterize the coalescence or third stage of film formation. As mentioned previously, scanning electron microscopy (SEM) has been used to measure the degree of coalescence by measuring the amount of contact between the fused particles.[14] Transmission electron microscopy (TEM) and small angle neutron scattering have also been

used.[6,7] Atomic force microscopy has been used to measure the surface relief of latex films.[10] Fluorescence has been used to study interdiffusion.[11,12]

The primary technique used in the present study, dielectric analysis, has been used previously by Dissado et al.[18] In their work, they used a simple two-electrode geometry that was in a coplanar arrangement on a glass substrate. Their data indicated a power law time decay in the conductance and hinted that there were multiple stages of drying. The present study strives to improve on their work by using a more sensitive electrode geometry and by using a more robust data analysis that eliminates the frequency dependence of the data and extends the range of the measurement. The purpose of this research is to provide insight into the physical mechanisms of latex film formation and the effect of ambient humidity. The model system studied in this work is not a simple latex emulsion but includes some ingredients that complicate the system. These ingredients not only affect the final characteristics of the film but also make the analysis of the film formation mechanisms more difficult. These ingredients were added, however, because they are representative of those used in commercial floor polish systems. It is hoped that the experiments described in this work will provide some foundation for further study of latex film formation with dielectric techniques.

EXPERIMENTAL

Material Formulation

The material used in this study, referred to as UDL01, is a typical formulation for a floor polish used as a sealer, and there was no low-molecular-weight wax component. *Table* 1 lists the ingredients used.

The main ingredient is the emulsion-based polymer. It contains 30% styrene, 17% methyl methacrylate (MMA), 40% isobutyl methacrylate (IBMA), and 13% methacrylic acid (MAA). There is also water, ammonium hydroxide, and an anionic surfactant necessary to stabilize the latex emulsion. In the dried film, the polymer is by far the dominant ingredient and is close to 85% of the content of the dried film. Differential scanning calorimetry (DSC) scans for the pure polymer component, as dried from the emulsion, are shown in *Figure* 1. This sample had none of the other additives. The first scan shows multiple glass transitions with inflection point temperatures at 29°, 101°, and 120°C. According to the DSC data, the beginning polymer was already multiphase. The sample in this scan was heated to 150°C then cooled back down and ramped again. The subsequent scan labeled as second shows the first T_g again, but the second and third T_g values have merged into one transition at 111°C. This is likely caused by the increased diffusional mobility and miscibility of these two phases above their glass transitions. Subsequent quenching then locks in the resulting phase behavior. These data were recorded at a heating rate of 20°C/min with a 16.8 mg sample.

Besides the main polymer, there is also an ingredient referred to as resin. The resin is actually a low molecular weight polymer (<8000) that is used to improve leveling, gloss, and adhesion. The resin is soluble in an aqueous alkali medium and functions by increasing the viscosity of the emulsion. The resin used in the sample formulation contains 32% styrene, 38% α-methyl styrene, and 30% acrylic acid.

The Zonyl FSJ fluorocarbon is used as a surface-active agent. Anionic and non-ionic perfluorinated chemicals are often used to help leveling by lowering interfacial tension at the interface between the floor polish and substrate. The one used in this sample contains 40% mono- and bisfluoralkyl phosphates complexed with an aliphatic quaternary methosulfate. The fluorocarbon formulation also contains 15% isopropyl alcohol with the remainder being water.

The zinc ammonium carbonate (ZAC) is used to improve resistance of the final film to detergents and to enhance durability. Divalent metal ions such as zinc are used to form ionic crosslinks in the film as it dries (after evaporation of water and ammonia). In this formulation we used a ZAC solution containing 35% ZAC and 65% water. The existence of these ionic crosslinks has an impact on the final film properties. In addition, the formation of the crosslinks should affect ion mobility, and, therefore, the ionic conductivity measured during film drying. Thus it is an important consideration in understanding the sequence of events during coalescence of the floor polish film.

The final set of ingredients includes tributoxyethyl phosphate, a simple plasticizer, and Carbitol, a coalescent. Tributoxyethyl phosphate has a freezing point of –94°C and a boiling point of 222°C. It effectively lowers the T_g of the floor polish, moving it closer to room temperature so that films are less brittle. The Carbitol [or di(ethylene glycol) ethyl ether] acts much like the plasticizer by softening the latex particles. However, part or

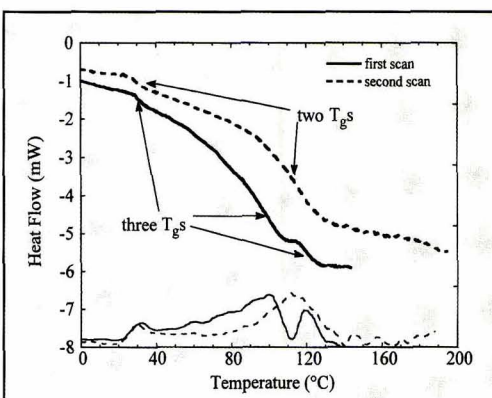

Figure 1—Pure polymer (dried from the emulsion) DSC scans showing multiple glass transitions. The first scan is the polymer as dried, and the second scan is after a quench from 150°C. The bottom two curves show the derivatives of the heat flow so the T_gs can be more easily located.

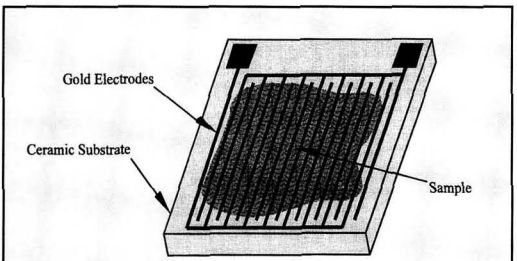

Figure 2—Representation of single surface comb electrode used to measure the complex impedance of the floor polish emulsion as it dries.

all of the Carbitol, with a boiling point of 202°C, presumably evaporates over time making it only a temporary plasticizer.[1] Carbitol is also hygroscopic so it may attract water molecules to the polymer causing further plasticization.

Dielectric Apparatus

Dielectric measurements were used to characterize the drying of the latex floor polish film in real-time. These measurements were conducted with a Hewlett-Packard 4192A impedance analyzer. The basic method consisted of measuring a sample response over a range of frequencies as a function of drying time.

The sample conductivity was measured with a single surface interdigitated comb electrode. It consists of interlaced gold fingers on a ceramic substrate and has a surface area of approximately 2 cm^2. A schematic representation of the electrodes is shown in *Figure* 2. The sample was cast on top of the electrodes, and then the response at different frequencies was measured. The HP 4192A impedance analyzer is capable of frequencies up to 13 MHz, and a one volt excitation signal was used for this experiment. The typical frequency range used in the scans for this study ranged from 10 Hz to 10 Mhz, and the data were sampled at four to eight different frequencies per decade. Because of the high frequencies used in this experiment, care was taken with the design of the connection to the sample electrode so that phase errors would be minimized. In addition, the impedance analyzer was zeroed with an offset that accounted for any residual impedance caused by the electrode connection geometry.

In the analysis of the dielectric data, quantitative values of the conductivity and permittivity were not calculated. This is because the comb type electrode geometry is not as easily modeled as a parallel plate arrangement. In the parallel plate case, there is usually some fringe electric field at the edges of the electrodes (because they are not infinite). However, this fringe field is a very small contribution to the overall capacitance and is typically neglected. In the comb electrode used in this study, the fringe fields are no longer negligible; in fact they are likely the major contributor to the measured response.

For most conductive materials, such as the floor polish emulsion, an appropriate model for the material is a resistor and capacitor in parallel. For this circuit, the admittances (1/impedance) are additive,

$$Y^* = \frac{1}{Z^*} = \frac{1}{R} + i\omega C \qquad (1)$$

where R is the resistance, C is the capacitance, and ω is the angular frequency. Since $Z^* \equiv Z' - iZ''$, solving for real and imaginary impedance then gives the following equations,

$$Z' = \frac{R}{1+\omega^2R^2C^2} \quad \text{and} \quad Z'' = \frac{\omega R^2 C}{1+\omega^2R^2C^2} \qquad (2)$$

It can be shown that these equations are the parametric equations for a circle of radius R/2, centered at Z'=R/2 and Z''=0 (when plotting Z'' versus Z').

When making dielectric measurements on conductive materials, blocking electrode effects can obscure the bulk properties of the sample.[19,20] In brief, this blocking effect is caused by the pile-up of the sample's mobile ions at the electrode/sample interfaces. As the ions accumulate at the electrodes, the sample becomes polarized, so a large false contribution to the dielectric constant is measured.[21] Besides the sample itself, two major experimental factors may be varied to control the electrode polarization. The first factor is the time scale. As the length of time for the experimental measurement is increased, the ions have more time to accumulate at the electrodes. Thus the blocking effect is minimized by taking data at higher frequencies (shorter time scales). The frequency at which blocking becomes important depends on the concentration of ions and the sample viscosity. The second factor that influences electrode polarization is the

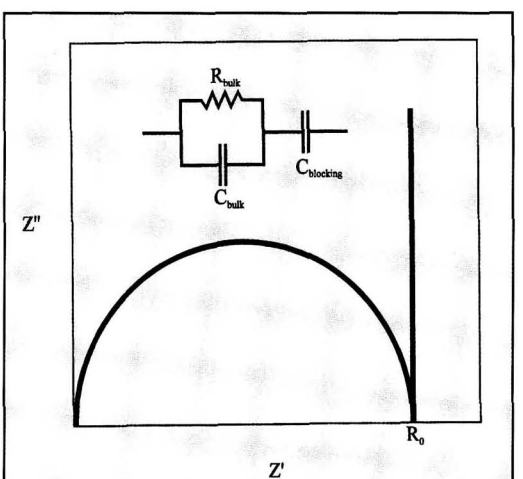

Figure 3—Circuit model of the dielectric medium that includes the electrode blocking effects as well as the bulk material impedance. The theoretical complex impedance plot for this material includes a semicircle characteristic of the bulk and a tail indicative of electrode blocking.

sample geometry. As the distance between the electrodes decreases, the amount of ions that pile up in a given amount of time increases. Thus increasing the spacing between electrodes can be used to minimize blocking effects.

Because of the high conductivity of a water-based emulsion, there is definitely a problem with electrode blocking effects. However, because the raw data (e.g., impedance) are available with the measuring system used in this study, it is relatively easy to diagnose when ions are piling up at the electrodes. For the latex floor polish, electrode blocking occurs only at the earliest stage of drying, when the water content is high and the ions have an easy path to the electrode. After enough water evaporates and the latex particles begin to pack into a regular array, ion mobility is restricted, so electrode blocking disappears. If not detected, electrode blocking can lead to erroneous results. However, diagnosis of these effects is easily accomplished by looking at a complex impedance plot of the data.[20]

To account for the pile-up of ions at the electrodes, the parallel resistor and capacitor model must be modified. Though there exist more complicated models of blocking effects,[22] the simplest model is made by adding a second capacitance in series with the original circuit. This is pictured in *Figure* 3.

For this model, the complex impedance is then given by,

$$Z' = \frac{R_{bulk}}{1+\omega^2 R_{bulk}{}^2 C_{bulk}{}^2} \quad \text{and} \quad Z'' = \frac{\omega R_{bulk}{}^2 C_{bulk}}{1+\omega^2 R_{bulk}{}^2 C_{bulk}{}^2} + \frac{1}{\omega C_{blocking}} \qquad (3\text{-}4)$$

These equations can be plotted on a complex impedance plot; this is also shown in *Figure* 3. Again there is a semicircle that represents the impedance of the material being tested, but there is also a vertical line that is caused by the ions blocking the electrode. R_0 is the resistance of the sample in the limit of zero frequency. Pictured in *Figure* 4 for comparison are some actual data from the latex floor polish sample under study. These data show the usefulness of the model in diagnosing the existence of electrode blocking in latex samples.

The blocking effect is geometry dependent, so interpreting electrode blocked data is difficult if not useless. Because it depends on the speed with which the ions can accumulate at the electrode, it is also time (or frequency) dependent. In *Figure* 4, each data point corresponds to a different measurement frequency. There are electrode effects at lower frequencies where the ions have more time to accumulate. At higher frequencies, electrode blocking is no longer a problem, and the data are a valid measure of the material characteristics.

Thermal Analysis Measurements

In addition to the dielectric measurements, dried latex floor polish films were subjected to other thermal analysis measurements. The data taken include differential scanning calorimetry (DSC) and thermomechanical analysis (TMA). These data were all taken with TA Instruments modules. For the DSC measurements, a TA Instruments DSC 2910 was used. A relatively fast temperature ramp of 20°C/min was used to sharpen the transitions, N_2 was used as a purge gas, and the reference pan was balanced with additional aluminum to minimize the startup hook. DSC sample sizes varied from 10 to 20 mg. For the TMA measurements, a TA Instruments TMA 2940 with a thin film fixture was used. Measurements were performed in a tensile mode with the sample clamped at both ends. A small amount of force held the sample in place (0.01 newtons), and the temperature was ramped at 1°C/min. TMA sample dimensions were 25 mm by 4 mm.

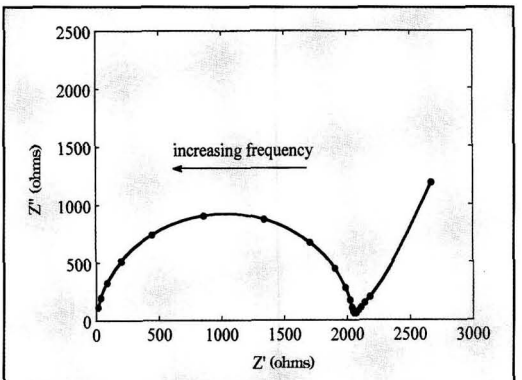

Figure 4—Measured latex floor polish data showing electrode blocking at some frequencies. These data confirm the usefulness of the equivalent circuit model shown in Figure 3.

RESULTS AND DISCUSSION

Dielectric Measurements

As previously mentioned, the main emphasis of this work has been to follow the drying of a latex film by measuring the conductance of the sample on a single-surface comb electrode. While the conductivity depends only on the sample, the conductance is not solely a material property but depends also on the electrode geometry. Thus the conductance does not provide quantitative data on latex film drying, but it is still an effective parameter for observing qualitatively, the mechanisms of latex film formation.

There are two types of conductances that can be measured. One is the apparent conductance, $G_{apparent}$, which can be derived from the parallel resistor and capacitor model discussed previously.

$$G_{apparent} = \frac{1}{R} = \frac{1}{Z'(1+\tan^2\delta)} \quad \text{where} \quad \tan\delta = \frac{Z''}{Z'} = \omega RC \qquad (5\text{-}6)$$

In an ideal material, this apparent conductance is independent of frequency. However, in most real systems the apparent conductance does indeed depend on the measurement frequency. In data taken for the latex floor polish formulation, the apparent conductance was found to vary by a factor of 10 or more over the range of measurement frequencies used (10 Hz to 10 Mhz).

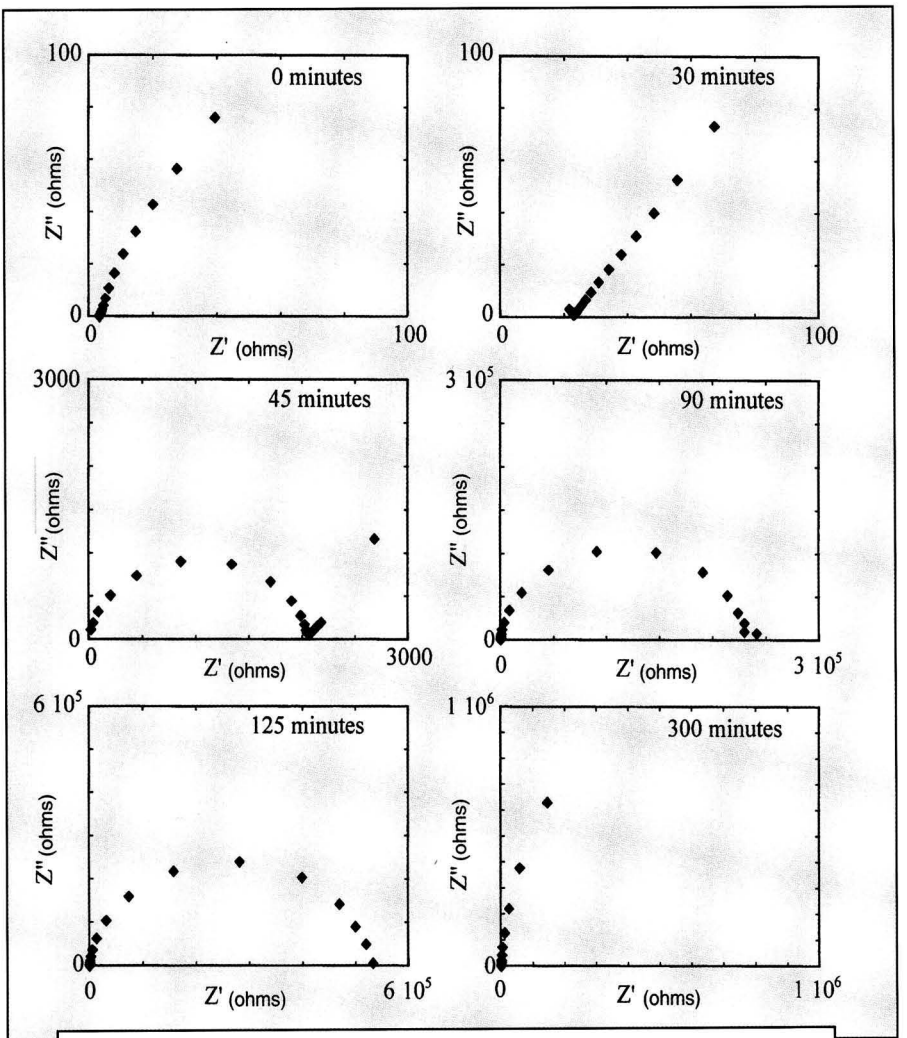

Figure 5—Complex impedance plots during the drying of a latex floor polish film.

An alternative conductance that is perhaps more useful (since it cannot vary with frequency) is the conductance in the limit of zero frequency. This zero frequency conductance, or bulk conductance, is denoted as G_0. Bulk conductance is calculated with a Cole-Cole analysis[23] on complex impedance data measured over a range of frequencies. The empirical expression developed by Cole and Cole when applied to impedance is,

$$Z^*[=Z'-iZ''] = \frac{Z_0}{1+(i\omega\tau_0)^{1-\alpha}} \qquad (7)$$

where Z_0, τ_0, and α are empirical constants, and $1/Z_0$ corresponds to the bulk conductance, G_0. With the expression $i^{1-\alpha} = e^{i(1-\alpha)\pi/2}$, the following relationship can be obtained,

$$Z'' = \sqrt{\left(\frac{Z_0}{2}\sec\frac{\alpha\pi}{2}\right)^2 - \left(Z' - \frac{Z_0}{2}\right)^2} - \frac{Z_0}{2}\tan\frac{\alpha\pi}{2} \qquad (8)$$

The measured data from each frequency scan were fit to the above non-linear equation using a multi-dimensional minimization algorithm.[24] A table of Z_0 values versus time were generated and then converted into conductance and plotted as a drying curve.

Figure 5 shows a set of complex impedance graphs that are typical raw data taken during the drying of the latex floor polish film. The individual data points in each plot correspond to complex impedance values at different measurement frequencies. Hence, this sequence of plots shows the progression of the measured impedance values as time increases and the film dries.

The first graph in this set taken at zero minutes. At this time, the impedance is very low and the electrode blocking effect is dominant at all measurement frequencies. The next plot, at 30 min, shows that enough water has evaporated so that at the highest frequencies, the electrodes are no longer blocked and the semi-circle

predicted by the parallel resistor and capacitor model is just beginning to form. The minimum in the curve corresponds to the zero frequency impedance. At 45 min most of the measured frequencies are no longer experiencing electrode blocking. At 90 and 125 min, electrode blocking is essentially non-existent. At 300 min, only the left portion of the semicircle can be seen because of the measurement limits of the impedance analyzer. Another detail to note with this data is that as time progresses, the intercept of the semi-circle, corresponding to the zero frequency limit impedance, goes to larger and larger impedance values (or lower conductance values).

Figure 6 shows a typical drying plot for a latex floor polish film dried at 27% relative humidity and 24°C. It is a log-log plot of the bulk conductance calculated using the Cole-Cole analysis discussed previously. The thickness of the measured film after drying is about 70 microns.

These data clearly show three different regions. The first region is marked by the lack of measurable conductance. This is because the sample is experiencing blocking effects in the entire range of measured frequencies. This induction period occurs when the ions are most mobile and therefore can quickly pile up at the electrodes. Eventually the ion mobility decreases to a point where blocking is not a problem for at least some of the frequencies. This region is labeled as stage 1 drying following a power law decrease in conductance with time ($\sim t^{-10}$). The boundary between the induction region and the stage 1 drying region is a function of the electrode geometry and does not necessarily indicate any physical transition. Finally, the drying curve shows a transition to a much shallower slope, termed stage 2 drying. This second stage of the drying process also obeys a power law ($\sim t^{-2}$). The transition from stage 1 to stage 2 drying is indeed a physical event, not an artifact of the measurement apparatus.

This curve shows the same behavior that Dissado et al.[18] observed in a study of the drying of latex paint. They observed a rapid drop in conductance followed by a slower power law decay. The initial rapid drop occurred over only a data point or two in their data. However, for the floor polish data, shown in *Figure* 6, the initial stage clearly goes on for a long time and also obeys a power law. It is possible that in stage 1, the faster drying rate is from open capillaries. As the water evaporates, the undeformed latex particles begin in point contact and deform into polyhedra. Under this mechanism, the transition into stage 2 occurs when the latex particles have deformed enough to begin sealing off the capillaries and trapping the mobile ions in the interstices. When the interstices have been sealed off, the evaporation of water is a diffusion limited process. This is similar to the mechanism proposed by Dissado et al., but the reader should be cautioned that this mechanism can be verified only with additional experiments.

It is important to consider the effects of environmental conditions on the drying mechanism. Temperature, for example, is important because it determines the softness of the latex polymer, and, therefore, the ability of the particles to deform and flow into a continuous film. Humidity is another important variable, and its effect is

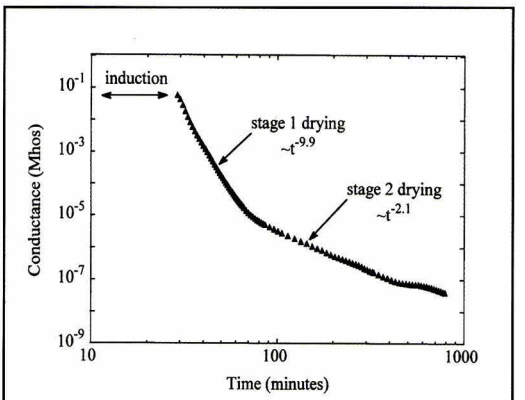

Figure 6—Typical latex floor polish film drying curve showing the decrease in conductance as time progresses and the film coalesces.

considered in the present work. *Figure* 7 summarizes the drying curves for the floor polish when dried at different relative humidities. The film thicknesses after drying varied from 50 to 70 microns, and the drying temperatures varied from 23 to 25°C.

The rate at which water evaporates from the latex is obviously dependent on the vapor pressure of the water in the air and, therefore, on the relative humidity. Harren[25] dramatically demonstrated the effect of ambient humidity conditions on the long term stability of a latex film by contrasting two samples: one painted under dry conditions and the other under humid conditions. Two years later the dry film cracked, while even after eight years, the humid film was still intact. Thus the humidity at drying is an important factor in determining the amount of coalescence of the film.

The data shown in *Figure* 7 clearly show the trend of increased drying time with increased humidity level. Of

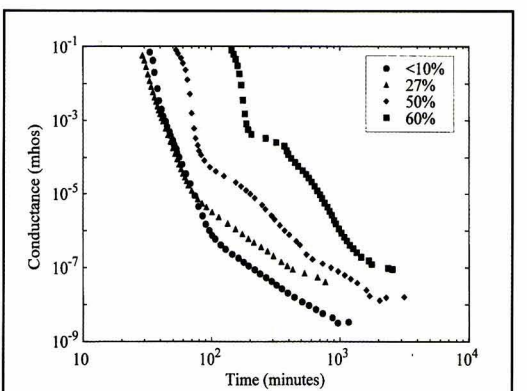

Figure 7—Summary of the drying curves at different humidities for the latex floor polish. The low humidity curves show power law dependence with two stages, while the high humidity curves show a more complicated time dependence.

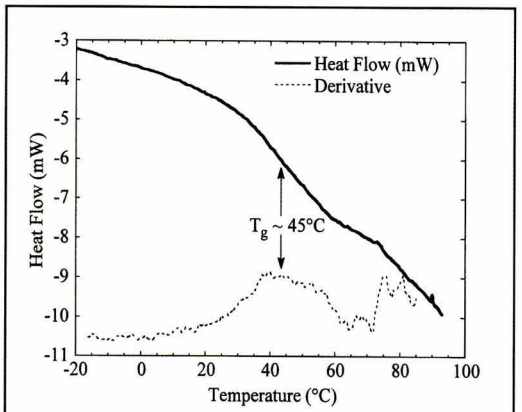

Figure 8—A typical DSC scan of latex floor polish four days after being cast and immediately after removal from substrate. The bottom curve is the derivative.

greater importance, however, is that the data provide evidence that the film formation mechanism may also change with humidity. Specifically at the lower humidity levels, the drying curves follow a power law in both stages 1 and 2. However at the upper humidity levels, the curves are no longer linear so the power law assumption is not necessarily valid anymore. In fact, the higher humidity data show that there may be an additional stage of drying that is not present in the lower humidity data.

In the latex floor polish system studied here, it was found that even at very low humidities and fast drying rates, a continuous film was still formed. Conversely, at very high humidities (>75% RH) and long drying times, the film was found to crack and rupture. This is contrary to intuition. However, a possible explanation can be provided by the presence of the coalescing solvent. According to Hoy,[15] the coalescing solvent is not necessarily evenly distributed between the aqueous phase and the polymer phase in a latex, and the distribution is highly dependent on the proportion of water to solids in the system. His data for Carbitol, which is used in the present system, shows that a majority of it remains in the aqueous phase, and it does not migrate into the polymer phase until almost all the water is evaporated. The implication is that the Carbitol migrates into the polymer only when the latex particles are deformed to their greatest extent. At this point, the Carbitol softens the latex and further aids the deformation. It could be argued that even at the shorter drying times, there is enough Carbitol in the polymer to sufficiently soften it for formation of a continuous film.

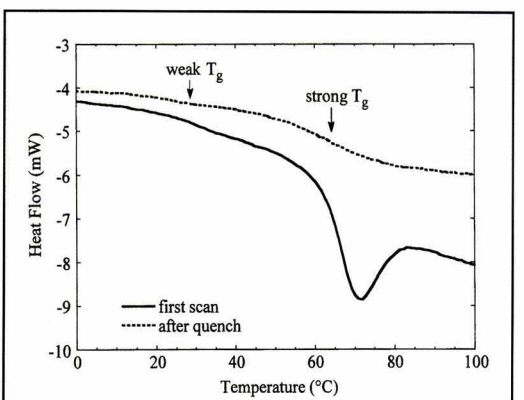

Figure 9—DSC scans of a latex floor polish sample two months after drying. The first scan shows a strong overshoot at the glass transition, and the second scan shows this overshoot disappearing after quench from 130°C.

Hoy's work does not address the issue of solvent evaporation, however, this may be the cause of the film cracking at humidities >75%. Sullivan[26] found that the water and solvent evaporate simultaneously during film formation. In general the water evaporates faster than the solvent, so sufficient solvent remains in the system to allow the latex particles to deform. When the humidity level is sufficiently high, water evaporation is slow. Under these conditions, it is possible that the corresponding solvent evaporation rate is fast enough so at the critical time of maximum particle deformation, there is not enough solvent left to soften the polymer. Then internal stresses become sufficiently high to cause the film to lose integrity. In the latex polymer studied here, the glass transition of the polymer dried without additives is well above room temperature (see *Figure* 1). Thus, it is important that there is enough solvent in the polymer to lower its T_g for film formation. It should be pointed out that Dobler et al,[17] who also studied the effect of humidity on latex film formation, did not see this high humidity effect. However, their study did not address the effect of coalescing solvents.

Dobler et al.[17] as well as Sheetz[9] asserted that a continuous skin forms at the top of the latex film, through which water must then diffuse. However, evidence of this could not be detected with the dielectric apparatus. It is possible that this experiment was not sensitive enough to detect this. The drying did occur, however, in a moving front manner—from the outside edges toward the center of the sample. The dielectric response was an average over the entire film.

One final effect that might be important is that at some point during the process of particle deformation and coalescence, ionic crosslinks form. The presence of zinc ammonium carbonate (ZAC) presumably forms these ionic crosslinks. As a salt, the ZAC is readily dissolved in the water when the floor polish is formulated. Thus, it is probable that the ionic crosslinks form at the interfaces between latex particles and do not occur internally. How this impacts the film formation mechanism or dielectric response is not known.

Thermal Analysis Measurements

Along with the dielectric measurements made on the latex floor polish samples, some limited thermal analysis experiments were conducted. These other techniques provide further insights into the characteristics of the

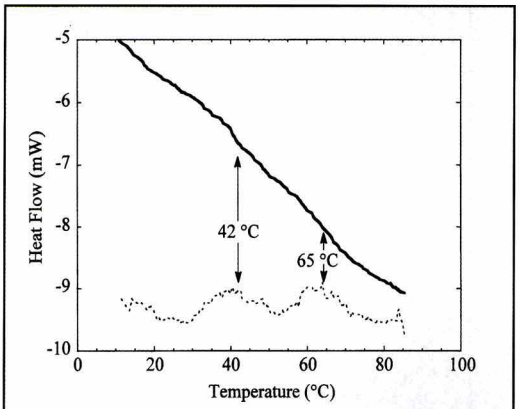

Figure 10—DSC scan of a latex floor polish sample that has been annealed at 75°C for 24 hr. Two glass transitions are visible, indicating the presence of two separate phases.

floor polish system. They include differential scanning calorimetry (DSC) and thermomechanical analysis (TMA) measurements.

DSC experiments were conducted on dried films of floor polish. *Figure* 8 shows the typical DSC scan of a dried floor polish film. These particular data were taken with a 9 mg sample size. The derivative plot is also included on this figure, and it shows that the inflection point of the glass transition is approximately 45°C. This plot also indicates that the glass transition is quite broad even at the relatively fast temperature scan rate. Thus it is difficult to detect the glass transition of this material with the DSC technique. It should be noted that this sample was measured four days after it was cast and immediately after being peeled off the aluminum foil substrate, so there was probably a considerable amount of residual volatiles still in the film.

The DSC scan data in *Figure* 9 are for a dried latex floor polish film approximately two months after being cast. There are two scans pictured and several interesting aspects to this data should be noted. The first aspect is that the main glass transition is no longer at 45°C as in *Figure* 8 but has increased to around 65°C. This is likely caused by the slow diffusion and evaporation of volatiles from the film that occurs even long after its initial coalescence. The second aspect is that the first scan shows an overshoot at the main glass transition. This enthalpy overshoot disappears in the second scan which was done after a quench from 130°C. There are two possible explanations for this overshoot: stress relaxation and physical aging. That the film is undergoing stress relaxation is confirmed in TMA data shown later. It is particularly interesting that even after two months of drying, there is still a considerable amount of residual stress in this material. Physical aging could also be occurring, and it is possible that the residual stress in the dried film accelerates this aging. A third aspect to these data is the appearance of a second glass transition. These two DSC scans show a strong glass transition near 65°C, and a barely detectable weaker transition closer to room temperature. Two glass transitions indicate the existence of two separate phases in the film. It may be that the second phase is caused by the lower molecular weight, water soluble resin that was part of this material, and this second phase formed in the interstices between the packed latex particles as they coalesced. However, the DSC scan of the pure polymer shown in *Figure* 1 shows the existence of this second phase already in the pure latex polymer, so it is possible that this is the source of the weak T_g.

The DSC scan in *Figure* 10 also shows the existence of two glass transitions. This particular sample was annealed at 75°C for 24 hr before this scan. The derivative curve is plotted in this figure to show the inflection points of the transitions. It should be pointed out that the possibility exists for migration of the plasticizer, tributoxyethyl phosphate, because of unequal solubility in the two phases. This could also contribute to the separation between the temperatures of the two apparent glass transitions.

A TMA experiment was conducted on a dried film specimen to measure the linear thermal expansion coefficient and the glass transition. These data are shown in *Figure* 11. The latex floor polish film used in these tests had been dried for two months so these data are comparable to *Figures* 9 and 10. *Figure* 11 confirms the DSC data in showing a much higher T_g value (73 and 85°C in this case) for films that are two months old. In addition, the curves show sudden decreases in thermal expansion coefficient during the glass to rubber transition, confirming the existence of residual stress.

CONCLUSIONS

Real-time characterization of the coalescence of a polymer latex film has been carried out using dielectric analysis. In this technique, the sample film is cast on an interdigitated comb electrode, and scans of complex im-

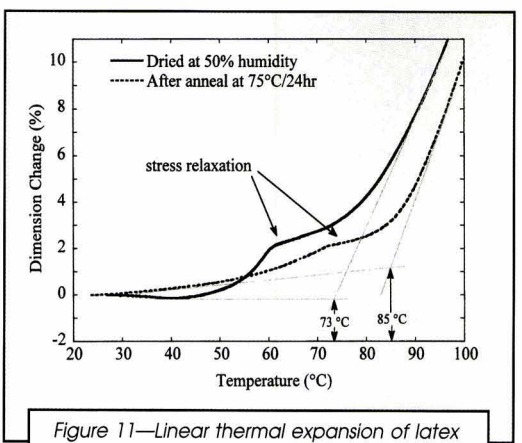

Figure 11—Linear thermal expansion of latex floor polish film two months after initial drying. Tangents are drawn to indicate the approximate glass transition temperatures. The intermediate peaks in these data show relaxation of the residual stress that exists in the cast film.

pedance versus frequency are made as the film dries. These data are reduced to give the zero frequency or bulk conductance, and this bulk conductance is plotted as a function of time in a log-log plot. The drying curves show that at ambient temperatures the drying mechanism varies as a function of humidity with the trend that as humidity is increased, water evaporation is slowed, and drying times are lengthened.

When drying at low humidities, the conductance as a function of time shows two distinct regions with two distinct, but constant, slopes. The drying follows a power law in these two regions. The difference between these two regions is interpreted as the difference between open capillaries between the latex particles with fast evaporation and closed capillaries with diffusion limited evaporation. At higher humidities, the power law approximation breaks down, and the drying curves become more complicated, showing that there may be an additional stage in the film formation mechanism. An additional effect was seen at very high humidities, which was the loss of integrity of the latex film. This rupture was caused by the internal stresses which became sufficiently high. An explanation for this is that at the slow drying times of these high humidity films, there was sufficient time for the coalescing solvent to evaporate, thereby increasing the modulus of the latex particles. Hence, the coalescent plays an extremely important role in the film formation mechanism.

In addition to the dielectric measurements, more traditional thermal analysis experiments were conducted to better characterize what happens as the material forms a film. The first characteristic noted is that the glass transition of the film covers a broad temperature range. Second, there was evidence that as the film dried over long time periods, the glass transition increased from room temperature to much higher temperatures (>65°C). In addition, a second glass transition appeared near ambient temperature that indicates some phase separation in the film. Third, there was also strong evidence that a considerable amount of residual stress remained in the film, even after a two-month period.

Latex film formation is a surprisingly complicated process which still sees much controversial discussion. Latexes used in practical applications contain additives that further complicate the drying mechanisms. This work has demonstrated that dielectric techniques can be used to measure the effect of various variables on the film formation. It has also helped to characterize a latex formulation that is typical of those used in practical applications.

ACKNOWLEDGMENTS

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Rheology of Acrylic Powder Coatings

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Flexibility in the functional design of acrylic powder coatings has enabled a wide range of different crosslinking chemistries to be developed, based upon carboxyl, hydroxyl, and glycidyl functional binders. The use of dynamic viscosity/time (temperature) cure curves is seen as a powerful technique to quantify formulation and resin design parameters. This paper describes how the technique can be used to highlight differences in the available crosslinking chemistries and begins to show how this can be used to predict coating performance on a more quantitative level. A simple model describing the viscosity changes during the curing process is presented, which shows good qualitative agreement with the experimental results.

INTRODUCTION

Continued improvements in formulation, application, and process economics have established thermoset powder coatings as a reliable and affordable finishing technology. Encouraged by the "four E's,"—excellence of finish, ecology, economy, and energy—the use of powder continues to be one of the fastest growing segments in the coatings industry today. A number of different technologies have been developed within the industry to address a diversity of end-use applications based upon polyester, epoxy, and acrylic polymer chemistry. The stated initiative of the automotive industry to apply thermoset powder more widely in critical application areas has led to a resurgence of activity in the area of acrylic powder coatings, primarily because of their established reputation for excellent outdoor durability and hardness.

Developed initially in Japan, there has been, until recently, comparatively little utilization of acrylic powder coatings in either the United States or Europe because of their poor mechanical properties as well as concerns regarding their compatibility with existing powder coatings technologies. As a consequence, there continues to be research activity that seeks to overcome the deficiencies of acrylic systems while retaining their substantial advantages. As part of an ongoing research activity within Zeneca Resins, we have set out to compare the curing behavior of the most widely developed thermoset acrylic powder technologies and to use rheological analysis as a descriptive tool for coatings performance. This paper describes some of the results of our experimental work and our attempts at modeling the rheological data obtained from a variety of formulated coatings.

Crosslinking Chemistries

Acrylic powder coatings currently being used and developed for use in thermoset powder coatings are based on glycidyl (GMA), hydroxyl (OH), and carboxyl (COOH) functional acrylic resins.[1] The range of available functionalities allows the use of different crosslinking chemistries. Typically glycidyl functional acrylics are cured with either long-chain dicarboxylic acids or acid anhydrides, while the hydroxyl functional acrylics can be crosslinked by both blocked isocyanates[1] and glycolurils.[2] Carboxyl functional acrylics are capable of being crosslinked by a number of different chemistries namely epoxy[1] and hydroxy alkylamide.[3]

Chemorheology

The process of film formation for a powder coating can be considered as consisting of two distinct stages: (1) the sintering of the polymer particles followed by (2) the flow out and leveling of the rough molten film. In a powder coating, the particles are often of similar dimensions to the film thickness and the coating cannot be directly applied in a smooth fashion. The presence of orange peel is often on the size scale of the initial particle size and is an indication of inefficient flow following application of the powder. In order to achieve maximum substrate protection and to obtain high gloss, it is essential that the processes of sintering and leveling are made as easy as possible.

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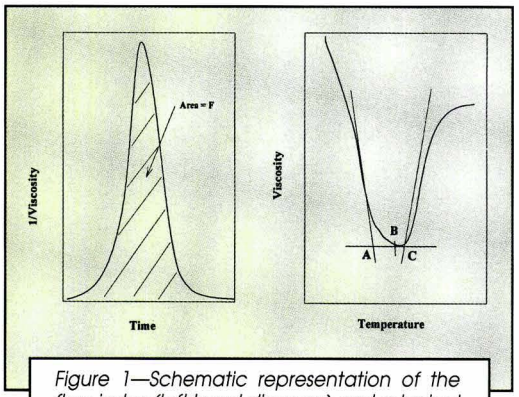

Figure 1—Schematic representation of the flow index (left hand diagram) and a typical cure curve showing at A the onset of cure, at B the minimum viscosity, and at C the onset of rapid cure (right hand diagram).

The timescale for sintering or coalescence of powder coatings particles under isothermal conditions (Stage 1) is given by Nix and Dodge's modification of the Frenkel equation[4] which relates the timescale for coalescence t to the average particle radius of curvature R_c, the surface tension γ, and the viscosity η and is given by:

$$t = f\left(\frac{R_c \eta}{\gamma}\right) \quad (1)$$

Thus for rapid sintering it is important to minimize the viscosity, maximize the surface tension, and minimize R_c. However, the viscosity cannot be reduced *ad infinitum* as a low melt viscosity will lead to sagging and poor edge coverage, and, similarly, an increased surface tension can cause a variety of coatings problems and final film defects. Thus, these parameters must be carefully balanced.

The timescale for leveling for a sinusoidal roughness (Stage 2) is given by the well known Rhodes and Orchard equation[5] for isothermal cure conditions:

$$\ln\frac{a(t)}{a(0)} = \frac{16\pi^4 h^3 \gamma}{3\lambda^4}\int_0^t \frac{dt}{\eta(f)} \quad (2)$$

where h is the average film thickness, λ is the wavelength, a its amplitude, γ is the surface tension, and $\eta(t)$ is the melt viscosity at time t. (NB: We assume constant surface tension during cure. Although this is not strictly correct, our experience indicates that the rheological changes dominate.) It is apparent that the driving force for leveling is surface tension. This is counterbalanced by the viscosity of the film which should be as low as possible to allow leveling under surface tension. Although it is possible to promote leveling by raising the coating surface tension, in practice, this can only be done within well defined limits if surface tension related defects are to be avoided. Thus, it is more practical to focus on the rheological properties of the film. The integral function is the area under the viscosity time curve and, after Achorn,[6] we define this as the flow index, F (*Figure* 1).

Note that the discussion has been limited to the case of Newtonian liquids in which viscosity is independent of the shear rates experienced during sintering and leveling. For unpigmented systems this is a reasonable assumption at least over the shear rate range experienced during film formation. However, non-Newtonian effects may well be apparent in pigmented systems in which the state of pigment dispersion is poor. In such cases the material will be highly shear thinning and may in extreme cases possess a yield stress (below which the viscosity is infinite), and the flow out of the film will be severely hindered. For this paper, however, the assumption of Newtonian viscosity will be maintained for simplicity. The issue of pigment dispersion and its effect on melt viscosity and leveling of powder coatings has been studied by Nix and Dodge.[4]

The melt viscosity-temperature profile for a typical powder coating for non-isothermal conditions is shown schematically in *Figure* 1. At low temperatures, the viscosity is high but falls as the polymer is melted. At A, the onset of cure retards the fall-off in viscosity until at B the viscosity reaches a minimum. At C rapid cure of the polymer becomes dominant and the viscosity rapidly rises. We define B as the minimum viscosity η_{min} and C the onset temperature for rapid cure T_{rc}. In this paper we use the parameters F, η_{min} and T_{rc} to characterize the flow of a powder coating.

There have been numerous studies of the rheological changes occurring during the curing of thermosetting powder coatings.[7-13] Many studies have concentrated on measurements performed under isothermal curing conditions. For example, Zosel[9] has studied the viscosity changes occurring during the thermal curing of thermosetting acrylic and epoxy resins and Hannon et al.[10] have studied the isothermal cure of pigmented epoxy powder coatings. Such studies have tended to use semi-empirical models such as those proposed by Roller[11] and Hannon et al.[10] to extrapolate the non-isothermal viscosity profile from the isothermal cure data. Roller[11] has studied the curing of B-stage epoxy resins and used a simple model to predict the changes under non-isother-

Table 1—Functional Acrylic Terpolymers

Polymer Code	OH1	GMA1	AC1	AC2	AC3
Functionality	Hydroxyl	Glycidyl	Acid	Acid	Acid
Acid value (mgKOH/g)	13-15	—	36.5	51.2	72.2
Hydroxyl value (mgKOH/g)	80-85	—	—	—	—
Epoxy equivalent wt	—	570-630	—	—	—
Mw (PS equivalent)	18,000-25,000	6,650	20,870	19,950	19,800
Mid point T_g(°C)	44-46	58	58	61	60
ICI C/P viscosity @ 200°C (poises)	35	10	40	50	60

mal conditions. Comparison of predicted and actual non-isothermal viscosity showed that the model has considerable utility. Eley[12] has applied this model to the curing of thermosetting powder coatings under non-isothermal conditions. An iterative numerical method[13] was used to determine the best fit of the model parameters to experimental curves for four different time-temperature curing rates. A similar model to that proposed by Roller has been developed by Kuwano[14] to describe the curing of unpigmented acrylic resins under non-isothermal cure.

In this paper we attempt to show the relationship between the resin structure and its curing chemistry and the rheological properties of an acrylic powder coating. It is shown that the rheological properties can be controlled by altering the nature of the resin. We also develop our own model to describe the curing of powder coatings and use this to highlight the important features of the rheological cure profile and its relation to the resins structure. In addition, we show how the rheological properties are related to powder coating properties post-application with particular reference to gloss.

EXPERIMENTAL

Acrylic Copolymers

Five different solid acrylic terpolymers were evaluated in our study representing the three most commonly available functional types. Two of these are commercially available samples: Neocryl XB1201 (Zeneca Resins), a hydroxyl functional acrylic resin hereafter referenced to as OH1, and Almatex PD-1700 (MTC), a glycidyl functional acrylic resin hereafter referred to as GMA1. Three experimental carboxyl functional acrylic resins were also prepared, and typical physical properties of all five resins are given in *Table* 1.

Powder Paint Formulation

In all cases, the stoichiometric level of acrylic resin to hardener was used, based on the crosslinker equivalent weight. Acrylic resin GMA1 was formulated with dodecanedioc acid (DDA), and acrylic resin OH1 with Vestagen B1530 (Hüls),[1] a caprolactam blocked isocyanate. The acid functional acrylic resins were formulated with both triglycidylisocyanurate (TGIC, Ciba Geigy), and Primid XL552 (a tetrafunctional hydroxyalkylamide from Rohm & Haas).[3] Powder coatings were formulated in a standard high gloss white formulation using TiO_2 (Kronos 2160) at a pigment:binder ratio of 1:2 by weight. Formulations were extruded via a Gay's twin screw extruder with a barrel temperature profile of 80/90/100°C at 130-150 rpm and 70 torque. The milled and classified (70 μm mesh) extrudate was applied onto 0.9 mm phosphated bonderite steel panels at a dry film thickness (DFT) of 70-90 μm. A range of cure conditions were utilized dependent on the crosslink chemistry.

Rheology

The flow properties of several powders were recorded on a Rheometrics RDSII dynamic rheometer. The RDSII was operated at 10% strain for all samples using a parallel plate geometry with a 2 mm gap. Strain sweep measurements showed no evidence for non-linearity under these conditions. The temperature ramp was 10°C/min for all samples and the frequency of the experiment was 10 rad.s^{-1}.

The Rheometrics RDSII applies an oscillatory strain at a defined frequency on the lower plate and measures the angular deflection at the top plate. From the damping and the phase of the measured signal relative to that of the applied deformation, the relevant moduli can be calculated. The complex modulus G* is defined as

$$G^* = G' + iG'' \quad (3)$$

where G' and G" are the storage and loss moduli relating to the elastic and viscous components of the modulus, respectively. The final crosslink density is related to the largest value of G' reached during the post cure measurement. The complex viscosity is given by

$$\eta^* = G^*/\omega \quad (4)$$

where ω is the angular frequency and η* is the complex viscosity, which is known for many polymer systems to superimpose on the viscosity data, obtained from continuous shear when the oscillation frequency is the same as the applied shear rate. Thus, it is possible to use the viscosity data under oscillatory shear in place of steady shear data.

Modeling

As described in the Introduction Section, there have been several attempts to model the viscosity changes

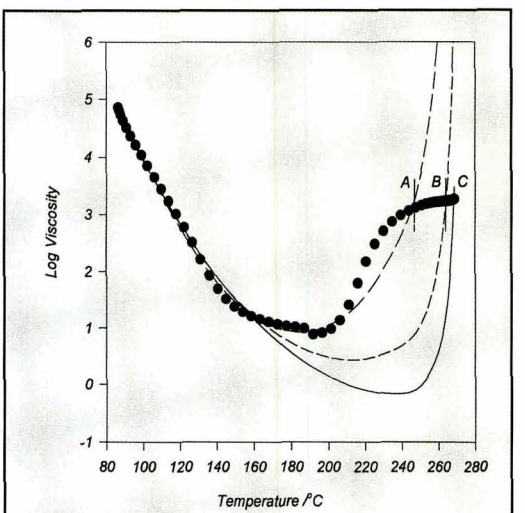

Figure 2—Rheological data for AC1 crosslinked with TGIC fitted to the Roller model (Equation 6) for different data sets. The three fits are for the full data set (curve C) and for sets truncated to temperatures beneath the points marked at A and B (curves A and B, respectively).

Table 2—Rheological Data for the Acid Functional Acrylics

Polymer Crosslinker		Rheological Parameters (10°C/min)			
Code		η_{min} (Pa.s)	T_{rc} (°C)	F (1/Pa)	G (x10^{-4}) P
AC1	TGIC	11	187	38	5.0
AC2	TGIC	18	178	11.5	13.3
AC3	TGIC	55	160	0.9	51.9
AC1	Primid	23	168	5.5	15.0

occurring during the curing of a powder coating. The basis of the dominant empirical model for isothermal cure is to split the viscous melting and crosslinking kinetics into two separate components:[11]

$$\ln\eta(t) = \left(\ln\eta_\infty + \frac{E_\eta}{RT}\right) + tk_\infty \exp\left(\frac{E_k}{RT}\right) \quad (5)$$

where $\eta(t)$ is the viscosity at time t and temperature T, E_η, and E_k are the activation energies for flow and cure, respectively, η_∞ is the viscosity at infinite temperature, and k_∞ is the first order rate constant for cure at infinite temperature. In order to describe non-isothermal cure, Roller[11] has proposed an integral form of equation (5):

$$\ln\eta(t,T) = \left(\ln\eta_\infty + \frac{E_\eta}{RT}\right) + \int_0^t k_\infty \exp\left(\frac{E_k}{RT}\right)dt \quad (6)$$

This model has been utilized with some success by Eley[12] for powder coatings cure. It should be noted, however, that this model has no term to describe the viscosity plateau which is observed at high temperatures and which is attributable to full cure. Thus it is our experience that the model fits are very sensitive to the data range over which the model is applied. In particular, it is apparent that inclusion of data from the full cure region (i.e., the plateau region described earlier) severely affects the derived parameters and the resultant quality of fit. This is shown in *Figure* 2 in which fits to the same experimental curves are shown for different ranges of data. As can be seen, the model describes the most truncated data set well but is a poor description for the more extended data sets. With this in mind, we have extended the model proposed by Roller to include a term x to describe full cure via the use of a simple mixing law in which the viscosity and cure terms are weighted by the consumption of available crosslinking functionality. The functional form of this mixing law is arbitrary because it is the simplest model available, but as will be shown in the following provides a semi-quantitative description of the cure data.

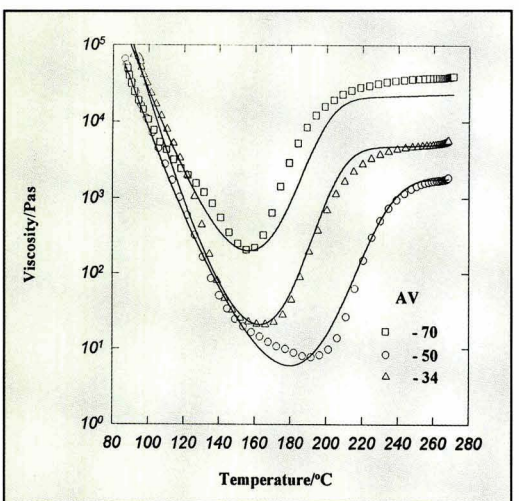

Figure 3—Rheological data for the acid-functional acrylics AC1, AC2, and AC3 crosslinked with TGIC. Model fit to the experimental data (Equation 7) are shown by the solid lines.

In analogous fashion to the models described, we assume first order kinetics and an Arrhenius dependence for the melt viscosity. Although this latter assumption is clearly inappropriate for the description of polymer flow[15] in which, a free volume-based description would seem more sensible, it is the simplest available picture and, as will be shown, seems to provide an adequate description of the observed behavior while avoiding over parameterization of the data during the curve fitting procedure. The model we describe is given by

$$\begin{aligned} \ln\eta(t,T) &= x\ln\eta_{visc} + (1-x)\ln\eta_{cure} \\ \eta_{visc} &= a\exp\left(\frac{E_v}{RT}\right) \\ \eta_{cure} &= cT \\ \frac{dx}{dt} &= -kx \\ k &= b\exp\left(\frac{-E_k}{RT}\right) \end{aligned} \quad (7)$$

where E_k is the activation energy for the curing reaction, x is the fractional contribution from polymer melting to polymer flow and relates to the fraction of available crosslinking functionality remaining at time t and temperature T, k is the rate constant for the curing reaction, E_v is the activation energy for flow, and a and b are constants. As can be seen from equation (7), the curing contribution to the viscosity becomes proportional to temperature with proportionality constant c once all the polymer becomes incorporated in the network, i.e., as $x \rightarrow 0$.

RESULTS AND DISCUSSION

Acid Functional Acrylics

The rheological results for the pigmented molar stoichiometric equivalent compositions are summarized in *Table* 2. *Figure* 3 shows the results for TGIC where we see that increasing the acid value of the acrylic resin, and hence effective resin functionality, leads to a rapid decrease in the ability of the system to flow. This is shown by the shift in T_{rc} to lower temperature on increasing acid value and the concomittant decrease in the flow index, F. As described previously, the ability of the resin

to flow out is dependent not only on the viscosity of the resin at a particular temperature but also on the time dependence of viscosity. The flow index embraces both features and is a useful tool for ranking the flow properties of a set of coatings. As can be seen, F varies from 23.5 for the lower functionality resin AC1 to 2.6 for high functionality resin AC3 with the values indicative of the superior flow of the former system. This resultant decrease in F is followed by a significant increase in the limiting network crosslink density as given by G', which is consistent with the higher level of crosslinker used with the higher functionality resin AC3.

The dynamic melt viscosity-temperature profiles for the two different crosslinkers, TGIC and Primid XL552 formulated with resin AC1, are shown in *Figure* 4, and the results are tabulated in *Table* 2. A number of features can be identified from the data. First, the relative plasticization efficiencies of the different crosslinkers can be observed. Primid XL552 shows no plasticization, while TGIC shows a 1°C suppression of the acrylic polymer T_g, respectively, per each wt-% in the formulation as measured by differential scanning calorimetry, DSC. This suppression is apparent in the melt region of the cure curve with the TGIC formulations showing lower viscosities than the resin formulated with XL552 at an equivalent temperature and stoichiometry. In addition to the plasticization properties of the crosslinkers, their different reactivities can be discerned. Primid XL552 shows rapid cure at lower temperatures than TGIC with a value for T_{rc} of 160°C compared to 187°C for TGIC. The high temperature limiting crosslink densities (based on the limiting value of G') for both TGIC and Primid XL552 are consistent with the effective functionalities of the respective crosslinkers.

The rapid low temperature onset cure and the resultant low flow index observed for Primid XL552 gives difficulties when formulating high gloss defect-free coatings due to the devolatalization of water generated on cure. However, it has been reported[16] that the addition of benzoic acid can reduce the effective crosslinker functionality by preferentially reacting with one or more of the more reactive hydroxyalkylamide group, which has the effect of decreasing the effective crosslinker functionality. *Figure* 5 shows the effect of addition of low levels of benzoic acid which has the effect of lowering η_{min}, and moving T_{rc} to a higher temperature. Both of these effects result in slightly improved flow and gloss but at the expense of reduced final crosslink density. It is clear from the discussion there is a strong interplay between final crosslink density and the ability of a resin to flow. Thus, it is necessary that a balance is struck between the requirements in terms of the degree of crosslinking and the rheological response of the system.

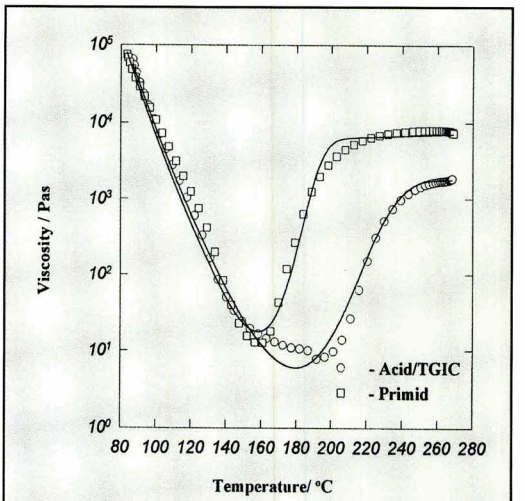

Figure 4—Rheological data for AC1 crosslinked with TGIC and Primid XL552. Model fit to the experimental data (equation 7) are shown by the solid lines.

Comparison of Different Functional Types

As previously discussed, there are currently three major types of binder functionality used in acrylic powder coating systems. *Table* 3 and *Figure* 6 summarize the results for standard carboxyl, hydroxyl, and glycidyl functional resins. The differences in the nature of the crosslinker chemistry are clearly shown. In particular, the GMA1/ DDA coating shows a rapid drop in viscosity due to the crystalline melting of DDA. This is followed by the rapid cure of the glycidyl/acid resin crosslinker system. The OH1/blocked isocyanate chemistry shows intermediate behavior to that observed for the carboxyl/epoxy and the glycidyl/acid combinations with the onset of rapid cure occurring at the deblocking temperature of the crosslinker B1530. The AC1/TGIC system behaves as described in the preceding sections.

The flow index is a useful measure of the ability of the resin to flow since it describes both time and temperature dependence of the resin viscosity. Therefore, there should be a close correlation between flow index and measurable coating properties such as gloss and distinction of image.[6,12] In *Figure* 7 we show one such correlation between the experimental flow index (F) and the measured 20° gloss based upon the three chemistries. Points along each of the curves were obtained by varying the three acrylic resin parameters of M_n, T_g and F_n, as

Table 3—Comparison of the Rheological Parameters for Different Binder:Crosslinker Chemistries

Polymer Resin	Functionality	Crosslinker	Rheological Parameters (10°C/min) η_{min} (Pa.s)	T_{rc} (°C)	F (1/Pa)	G (x10^{-4}) Pa
AC1	Acid	TGIC	11	187	23.5	5.0
OH1	Hydroxyl	B1530	7	177	26.4	27.7
GMA1	Glycidyl	DDA	4	154	33.3	85.6

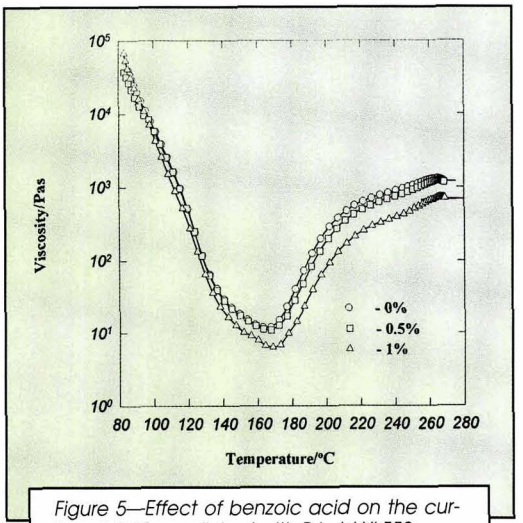

Figure 5—Effect of benzoic acid on the curing of AC1 crosslinked with Primid XL552.

Table 4—Model Parameters from 10°C/min Model Fit

Sample	log a/Pa.s	E_η/Jmol^{-1}	log b/s^{-1}	E_k/kJmol^{-1}	c/Pa.sK^{-1}
AC1/TGIC	–42.2	159	7.5	73	3.3
AC2/TGIC	–52.8	195	8.9	81	9.3
AC3/TGIC	–38.5	151	8.9	80	42
AC1/Primid	–43.7	163	13.9	122	13.1
OH1/B1530.....	–39.6	149	12.3	113	37.8
GMA1/DDA	–59.8	205	15.4	130	134

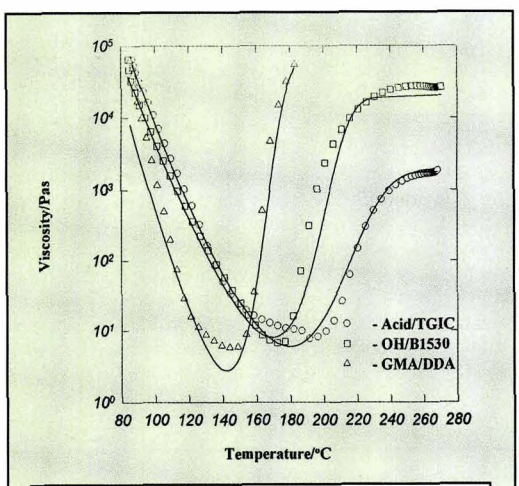

Figure 6—Rheological data for hydroxyl, acid, and glycidyl functional acrylics crosslinked with B1530, TGIC, and DDA respectively. Model fit to the experimental data (equation 7) are shown by the solid lines.

well as curing conditions. There is no universal trend encompassing all three chemistries, but, rather, there appears to be a unique correlation within each crosslinking chemistry, which can be used predictively. A possible explanation for this is given later.

Modeling

The application of rheological methods has been shown in the preceding sections to be of considerable use in highlighting the differences between different components of a powder coating. In particular, it is possible to discern the underlying reasons for any apparent flow related problems such as poor leveling or poor gloss obtained from a particular coating. However, the use of the experimentally determined parameters such as flow index and crosslink density obtained from a single cure rate tells only part of the picture. The modeling of the experimental data not only allows the derivation of additionally important parameters such as the activation energies to flow and cure, but also enables the extrapolation of flow behavior obtained from one experimental cure rate to that which would be obtained from any time-temperature cure regime. Clearly, it is important to be confident in the applicability of the model before relying on the results from such an analysis. The model we propose relies on the adoption of a simple mixing law to describe the shifting balance between the contributions associated with polymer melting and polymer crosslinking and also assumes that polymer flow is described by an Arrhenius temperature dependence. The functional forms of both of these terms are somewhat arbitrary but were adopted for the sake of simplicity.

Figure 8 shows the results obtained from fitting the model described to the experimental data under different time-temperature histories obtained for the acid functional acrylic, AC1 crosslinked with TGIC. The experimental data for four different cure rates from 2.5 to 20°C per min are fitted using a global analysis of the four sets. As can be seen, the model describes the data very well despite the assumptions inherent in the model. The fact that four different data sets can be fitted to the same model parameters gives some confidence in the applicability of this model.

The parameters obtained from fits to the 10°C data for the acid-functional acrylics AC1, AC2, and AC3 are shown in *Table* 4. The quality of the model fit to the experimental data is shown in *Figure* 3. The values obtained for the activation energy of flow (E_η) range from 195 kJmol^{-1} for sample AC2 to 150 kJmol^{-1} for AC1. The molecular weights of all three samples are very similar. Thus it maybe expected that E_η should be approximately constant. The fact that a constant flow activation energy is not obtained can be ascribed either to the use of the Arrhenius function to describe polymer flow or the differing extent of intermolecular hydrogen bonding between the polymer chains. However, on examination of the experimental data in *Figure* 3, it can be seen that the flow region (i.e., temperature below η_{min}) does not show a straightforward logarithmic dependence for all three samples. Instead, it is noticeable that the melting region

shows some form of transition in the region of 120°C. This is most apparent in the sample AC2 and might arise from the melting and subsequent mixing of the crosslinker TGIC due to incomplete mixing in the extrusion step. The fact that no plasticization is apparent beneath the transition temperature lends some credence to this hypothesis. The activation energies for cure (E_k) are of the same order of magnitude for all three samples. This is as expected as the crosslinking chemistry is identical in all three systems. DSC measurements of the crosslinking kinetics also show that E_k is independent of the acid value of the acrylic polymer. The value for E_k obtained from such DSC measurements is 101 $kJmol^{-1}$, whereas the average value from the rheological data is 78 $kJmol^{-1}$. Although the agreement is not exact, we feel that given the experimental errors for both techniques and the approximations in the analyses, these values are reasonable. The variation in the constant c is a reflection of the different rate of change of crosslink density obtained upon variation of the polymer acid level and varies from 3.2 to 42 for the low and high acid value resins respectively.

The results of fitting to the experimental data for Primid XL552 (*Figure* 4) shows the changing activation energies to cure as the crosslinker reactivity changes. The value for E_k is approximately 40 $kJmol^{-1}$ higher for Primid than TGIC, thus reflecting the differences in reactivity of the two crosslinkers. The variation in the flow activation energies and the pre-exponential factors reflect the plasticizing abilities of the different crosslinkers. Also shown in *Table* 4 are the model parameters for resins OH1 and GMA1 (*Figure* 6). For the different binders, the values for E_η and E_k would be expected to vary since the curing chemistries and the resins' molecular weights are different for each binder type. The large negative value of log a for the GMA1 system is representative of the good low temperature flow for this system, and the large value for E_η shows the rapid drop in viscosity observed once melting occurs. Similarly, the curing kinetic parameters show that crosslinking onsets at relatively low temperature, and the system reaches full cure very rapidly. The high value for the constant c shows the high level of crosslinking observed for the GMA functional resin.

In *Table* 5 we show a comparison of the experimental and model values for the flow index, F. There is generally good agreement between the two sets of values, although generally values for $F_{model} > F_{expt}$. The difference between the two values is greater when the value of η_{min} is small. It is our belief that F_{model} could be taken to be a more accurate description of polymer flow since at low melt viscosities there is a loss of sensitivity in the measurement. This leads to an over estimation of the experimental melt viscosity and, thus, to a less reliable figure for F_{expt} due to the very small values of the measured torque.

From examination of the quality of fits, it can be seen that the semi-empirical model we propose describes the data well and appears to have some utility in describing the cure kinetics of thermosetting polymers. In addition, the model parameters can be used to describe the kinetics of flow and cure. It is a simple step to use these

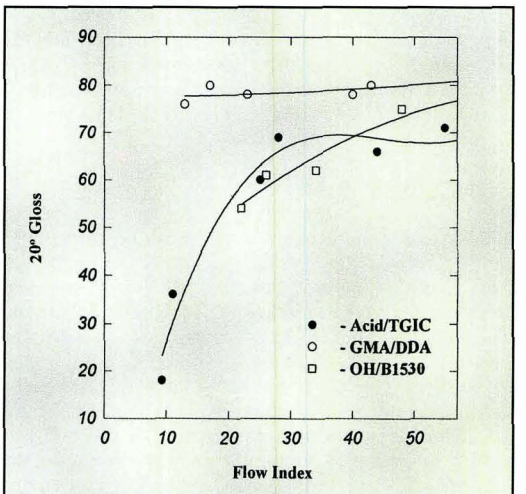

Figure 7—Correlation between 20° gloss and the experimental flow index for several different coatings.

Table 5—Comparison of Experimental and Model Values of Flow Index, F

Sample	Heating Rate (°C/min)	F_{expt} (1/Pa)	F_{model} (1/Pa)	η_{min} (Pa.s)
AC1/TGIC	2.5	25.4	32.8	—
AC1/TGIC	5	27.6	38	—
AC1/TGIC	10	38	43.6	11
AC1/TGIC	20	30.9	53.4	—
AC2/TGIC	10	11.5	9	18
AC3/TGIC	10	0.9	1.4	55
AC1/Primid	10	5.5	9.2	23
OH1/B1530.....	10	26.4	28.9	7
GMA1/DDA	10	33.3	41.2	4

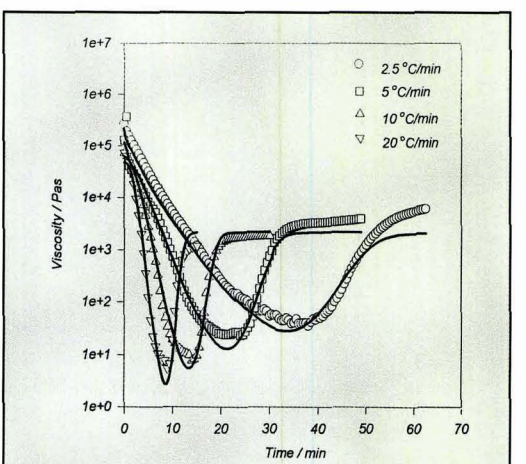

Figure 8—Model fit to the experimental data for AC1 crosslinked with TGIC for four different cure rates from 2.5 to 20°C per min using a global analysis of the four data sets.

parameters to predict flow under any curing conditions. In this way the model can be used as a predictive tool for viscosity changes occurring on a particular substrate under a particular curing schedule providing the time-temperature profile for the baking process is known.

CONCLUSIONS

In this paper we demonstrated the use of chemorheology for the study of the crosslinking of acrylic thermoset powder coatings. The differences in the nature of the crosslinker chemistry are clearly shown. In particular, the glycidyl acrylic/DDA coating shows a rapid drop in viscosity due to the crystalline melting of DDA. This is followed by the rapid cure of the glycidyl/acid resin crosslinker system. The carboxyl acrylic chemistries show the highest crosslinking temperatures, although this is shown to be highly dependent upon the choice of crosslinker. The hydroxyl acrylic/blocked isocyanate chemistry shows intermediate behavior with the onset of rapid cure occurring at the deblocking temperature of the crosslinker. The use of the experimentally determined flow index (F) is found to be a useful measure of flow dependent coating properties. The correlation between F and the measured 20° gloss is shown for each of the chemistries, although there is no universal trend encompassing all three chemistries.

We have also demonstrated that a simple model can be used to describe the rheological processes occurring during the curing of a powder coating. The adoption of a simple mixing law, relating to the consumption of the crosslinker, has allowed the development of the model proposed by Roller[11] to describe the full curing reaction. In particular, it has enabled the viscosity plateau observed at full cure to be incorporated in the fitting procedure, thus reducing the sensitivity of the fits to the region of data modeled. This model has shown that it can be used to provide global fit of several data sets recorded at differing curing rates on the same coating. The quality of fit gives confidence in the model we propose. The model can easily be used as a predictive tool for viscosity changes occurring during the curing of a coating on any substrate under any curing conditions providing the temperature changes occurring on the substrate are known.

ACKNOWLEDGMENTS

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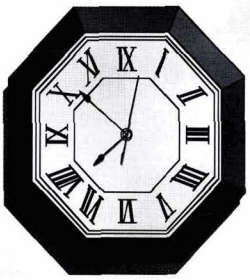
How Much  Do You Spend in Training?

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Using LCA to Select Coatings for Optimum Environmental and Cost Performance

Nick J. Hazel—BP Chemicals*

Introduction

The proposed legislation in Europe[1] governing air quality, while expected to control (among others) industrial emissions of solvent vapor, concedes that solvents play a key technical role in delivery of performance to the customer. It is not the use of solvents that is a problem, however, it is unnecessary or uncontrolled emission of their vapor into the lower atmosphere that contributes (with NO_x) to occasional episodes of ozone pollution under adverse weather and geographic conditions.

Most VOC species are very short-lived and are destroyed within a matter of hours or days. Given that at the boundaries of properly managed factories their concentrations are well below occupational exposure limits (with added safety factors), it should be clear that the only issue with industrial VOCs is the one of secondary ozone generation.

While many large coatings users will find end of pipe measures the most economically efficient VOC control option, technology change will be the method chosen by other (particularly small) coatings users. The main options, which may be used in combination with each other, in paint systems are:

- Higher solids and high solids;
- Water-based; and
- Powder or other low VOC coatings.

Compliance may still require some end of pipe equipment to be installed even after technology change. A number of different criteria will normally be used in a decision to select a particular technology:

Performance:—Typically, a number of key performance criteria will be built into a purchasing specification e.g., hardness, gloss, DOI, corrosion/etch testing.

Economics—Costs of raw materials, capital equipment, utilities, and changeover cost, such as training, need to be considered.

Environmental:—Each company/site will have environmental priorities set by national and regional legislation and company policy goals. Usually, these will have a local perspective e.g., site water effluent consents.

Unfortunately, these criteria are not independent of each other. It is being more widely recognized that a law of diminishing returns and increasing costs apply to nearly all pollution control measures; therefore, cost and environmental performance are intimately linked.

An important lesson from the science of ecology is that ecosystems are tolerant to a level of stress. This is possible because many of the materials which we regard as pollutants in high concentrations have lower natural levels in, for instance, soils. Alternatively, and particularly for simple organic compounds, active (chemical and biochemical) destruction mechanisms exist that most of these pollutants never build up to concentrations that cause problems. These ideas are now mainstream environmental thinking, appearing, for example, through the UN Environment Program as the "critical load approach."

The existence of ecosystem tolerance thresholds for many pollutants make the cost benefit argument very important: Which of the three criteria should have the greatest weight? A company that takes on excessive pollution control, will be less economic, and risk losing market share (particularly in world markets); where is the benefit to the environment then, if its custom is taken up by a less clean competitor?

Established practices exist for engineering and economics. Is there a similar environmental metric? How does it compare with the traditional measures?

Life Cycle Assessment (LCA)

LCA is a technique that provides the user with a broader perspective on the environmental effects of the use of a product. It seeks to quantify the burdens associated with particular industrial processes by taking into account activities connected with, say the manufacture of an article, from the extraction of raw materials through all process stages, use, and disposal of that article.

Whereas most perspectives on pollution center on a local activity, for instance, the coating of a manufactured article, LCA gives a more global view. The emissions at point of use of a coating are important and are those most under the control of the applicator, but the decision to use a particular coating technology or control option has wider implications as well. For instance, in the choice of energy type, local use of natural gas for heating has lower emission (globally) than using electricity for that same job, even though emissions from the latter may be made quite remotely from the site.

A widely expressed concern is that while air quality may be improved, this may be to the detriment of water quality from a different phase of the industrial process. LCA can at least highlight where these trade-offs may occur.

LCA also might be used to emphasize that whatever the current issues and competitive interests in the coatings field, painting to protect capital goods, or food items is a very green activity. The consequences of not painting are very serious yet surprisingly are seldom quantified.

Methodology

Although LCAs of coatings have been carried out[2] and there exists a code of practice covering the initial phase of inventory data gathering (life cycle inventory, LCI),[3] no one has yet developed a set of guidelines for the specific problems and challenges for LCAs within the coatings industry.

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Table 1—Illustration of the Variation of Wet Paint Use for Different Technologies and Application Methods

	Solvent Basecoat Base Case	WB Basecoat High-Solids High TE	WB Basecoat High-Solids Low TE	WB Basecoat Low-Solids High TE	WB Basecoat Low-Solids Low TE
RFU solids levels (%)	23.3	23.3	23.3	18.7	18.7
Paint usage (kg/unit)	4.80	5.74	9.36	6.95	11.47
	Solvent-Based Clearcoat for SB	**Solvent-Based Clearcoat for WB**	**Solvent-Based Clearcoat for WB**	**Solvent-Based Clearcoat for WB**	**Solvent-Based Clearcoat for WB**
RFU solids levels (%)	48.9	48.9	48.9	48.9	48.9
Paint usage (kg/unit)	1.89	1.95	1.95	1.95	1.95
Paint usage: base + clear (kg/unit)	6.69	7.69	11.31	8.90	13.42

N.B. European formulations in use on a typical sedan.
TE: Transfer efficiency (paint on car/total used)
RFU: Ready for use.

The primary utility of LCA is process oriented, where optimization of environmental performance can be addressed in an incremental manner, in the same way that engineering or cost optimization might be carried out.

However, in reality, managers in coatings manufacture and purchasers in end-user companies will want to compare technologies as part of their decision making processes. Technology comparisons are, therefore, inevitable, and these imply the possibility of non-incremental (i.e., macro) changes. If LCA is going to be used in this way, the studies need to be soundly based.

Scope

Systems

Because coatings provide a very necessary and demanding protective function, they are neither simple nor are they always applied simply. More often than not an individual coating is part of a total coating system which may include several other layers, as well as pre- and post- application treatments, such as the removal of the coating during the service life of the article that is being protected.

LCA not only can, but should be used on whole systems, especially when the performance of one element may be heavily dependent on the nature of another. Frequently, the emissions of one coating in a system are impossible to disentangle from those of other components anyway (e.g., with wet-on-wet coatings, or during cleaning or reclamation operations).

Data Sources and Quality

The major difficulty comes in gaining access to upstream data, which is essential for a soundly based LCA and probably represents the biggest hurdle to the company involved. For only a limited number of materials, principally plastics and their feedstocks, are public data available at low cost.[4] One way forward is to generate a cooperative exchange of information and expertise through the supply chain, which takes time and effort; reasonably high quality data can result though it is likely to be fairly site specific. The alternative is to purchase a database from a consultancy firm active in the area or from one of the universities. Needless to say, this may require a considerable up-front investment. One then has no control of the data quality, and it is possible (even likely) that a single commercial database will be insufficient for the needs of a study.

It is always important to bear in mind that even the best primary data have a limited quality, since the environmental performance (e.g., energy efficiency) of a chemical plant is dependent on many factors, including operating rates.

Because of the chemically complex nature of coatings (especially if a system is being described), there is a special order of difficulty associated with LCA here. In the automotive study presented last year,[5] we examined 60 different unit processes, and that number was kept down as follows: (1) by using a cut-off to replace minor components with an average process while keeping track of any specific pollution issues; and (2) by using sensible chemical substitution of more important materials for which LCI data wasn't available, by functionally similar ones for which it was.

To conduct a comparative life cycle assessment of coatings, the operator who

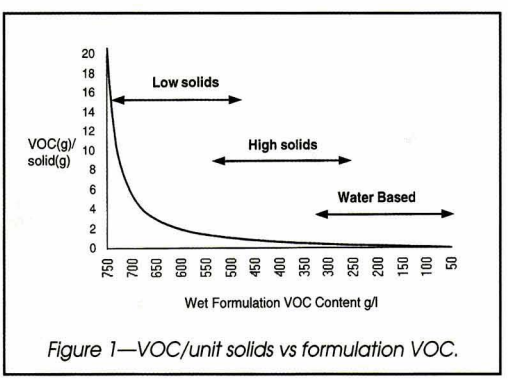

Figure 1—VOC/unit solids vs formulation VOC.

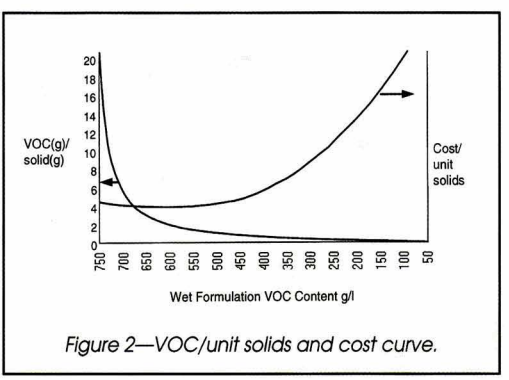

Figure 2—VOC/unit solids and cost curve.

has optimized competitive technologies coating the same article on identical machines in the same factory is blessed indeed. Needless to say, it is very rare that such high quality comparative data are available. Without it, progress on the application process has to be made cautiously and with due regard to the issues raised in the next section. Moreover, it must be stressed that there is no substitute for real data on a fullscale process.

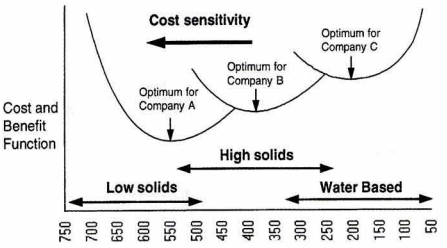

Figure 3—Cost benefit vs formulation VOC.

Basis for Comparisons

Functional Unit

A very important discipline that LCA brings to thinking about the environmental effects of using coatings systems is that of the functional unit. Legislators tend to concentrate their efforts on the can of wet coating and develop a number of criteria for different systems and end uses based on a mass of organic volatiles per unit volume of paint. This apparently simple linear relationship between VOC content and paint volume is in fact highly misleading, because less higher-solids paint is required per coated article such as a can or a car. Where a functional unit cannot easily be based on an individual item, then one defined on a unit surface area is the alternative (e.g., 1.0 m^2, as in the EC Ecolabel for decorative paints).[6] Either the paint on an item, or a fixed area, respects the fact that it is ultimately the solids (binder and pigment) that deliver the performance of a coating.

Therefore, the functional unit in a comparative coatings study must reflect actual usage. Different technologies, for reasons of application efficiency, performance, and solids level, may require very different amounts of wet paint to be used. *Table* 1 shows this for European automotive OEM basecoats,[5] where a considerable variation in wet paint consumption to do the same job is evident.

The use of a functional unit shows that the relationship between VOC content of a liquid paint and the usage of paint is more complex (*Figure* 1). Here, the VOC aspect of environmental performance is conveniently measured by a mass of VOC emitted per unit solids.

The graph shows strong curvature, and it is clear that the greatest benefits come from a relatively easy shift from low to higher solids. The more difficult task of reducing the VOC of an already low system will yield much smaller benefits. Typical (but not exclusive) ranges for some technologies are also shown in *Figure* 1.

This kind of behavior can be modeled in a simplistic manner:

$$y = \frac{1}{(\rho_{sic} / x) - (\rho_{sld} / \rho_{sv})}$$

x is the VOC content of the wet coating in g/l, y is the VOC (g) per unit solids (g), where ρ_{sld} is the density of the solid film in g/l, and ρ_{sv} is the density of the solvent, in the same units. Although formulation change is not a continuous process, smooth curves are useful tools for discussion.

Figure 2, on the other hand, illustrates how costs might increase with smooth changes in formulation. Given that there are two opposing trends, there is likely to be an optimum point where acceptable emission reduction is achieved at a reasonable cost. Several such minima are illustrated by *Figure* 3. The optimum point is shifted according to a company's sensitivity to cost by using a different mathematical equation (e.g., for notional companies A,B,C). Additionally, different end-user sectors will have different cost curves, rising more or less steeply depending on circumstance. This will result in a spread of optima (optimum = curve minimum) as well.

Performance Matching

Following on from the discussion of the functional unit based approach, another very important consideration is that of technical performance. In many circumstances environmental performance mirrors the technical one.

Accordingly, meaningful LCA comparisons can only be made on the basis of equivalent performance, which is a function and so must be intimately linked to the functional unit. Indeed, given that there is such a range of possible performance levels in this industry, a statement on it should naturally form part of the functional unit definition.

Performance must be one of the most difficult issues to address in coatings studies, since there are many different measures of performance within a specification. Different technologies will almost certainly never have the same performance pattern, and this is being acknowledged more widely these days. However, in many cases there will be key performance criteria that must be met, and these need to be identified and form the basis of an LCA comparison.

Within the constraints of acceptable performance, reformulation to achieve a faster or lower temperature cure is a very worthwhile approach since the savings in energy and, therefore, energy related emissions can have a significant beneficial effect on the LCI. Conversely, the use of more specialized materials means that the raw material manufacturing emissions are likely to go up since these materials are usually processed to a higher degree. Thus, not all the anticipated gains are necessarily realizable.

If reformulation is only being carried out to reduce VOC emissions, then this will result in the possibility of some increased emissions of other materials to air or water, for instance, from energy consumption. This is a classic trade-off; one could draw a graph similar to *Figure* 2 with these other emissions replacing cost. Some sort of optimum situation analogous to *Figure* 3 is also implied. Information of this kind is very useful in end-user discussions with regulatory authorities to ensure that an appropriate and overall beneficial level of pollution control is installed.

If the customer will tolerate a different level of performance in the future, then the question of whether the current coating is over-specified needs to be addressed. Can it be reformulated or the current process optimized, in the same manner? Returning to a point made earlier about the primary use for LCA, improving a currently used system would almost always be beneficial in cost and environmental terms: a no regrets approach.

There is a hidden benefit to working on existing systems, which is the minimization of risks associated with substitution. The industrial use of chemicals is an example of managed risk. Familiar materials are more or less hazardous, but the hazards and precautions needed to minimize the risk in use are well understood. If a chemical substitution is

made, there may be an increased risk from a less understood hazard (particularly for long-term effects). Because this is a highly complex area with its own professional expertise and methodologies, LCA studies should avoid addressing human health effects.

State of the Art

It can be very tempting to set up a comparison between a prospective new system (for which real industrial application data may or may not be available) with an established one that has not been developed or optimized for a long time ('state of the ark'). The intellectual justification for such a comparison is questionable. If one is considering a technology change and is genuinely interested in improvement, one should look at all the up-to-date options. The question to ask is "What is the best that any of the technologies have to deliver?" Too often an old, constrained system is compared with a competitive one that has been optimized for a given piece of equipment through clever reformulation.

Analysis

Many workers in the LCA field have developed methods to analyze and simplify the complex inventory into a smaller group of factors or even a single number; there are almost as many methods as practitioners in the field. This is an area of continuing controversy and one which provides many people with an excuse for not taking the messages of LCA seriously. It is beyond the scope of this paper to review the current position on impact analysis, which usually seeks to group emissions by common effects, and then valuate one type of ecosystem effect against another.[7]

However, a common sense approach to analyzing the inventory can help the interpretation and either show a direction for improvement or set minimum performance criteria for technology change while avoiding controversy. In fact, most of the outcomes of this kind of analysis should not be surprising, but LCA does allow some sort of quantification of contributions and potential improvements. Priority emissions can be tackled first, but few companies (and governments) have only one emission of concern, so trade-offs must be noted.

The main steps are:

Sensitivity analysis: Using a knowledge of the data quality, the range of solids levels/application techniques (currently in use and up to state-of-the-art) and a number of similar emissions between two systems can justifiably be removed from comparison (on statistical grounds).

Principal contribution analysis—For the remaining emissions, use of an emission/subsystem matrix will enable the identification of those subsystems contributing most to individual emissions. A number of subsystem elements with low burdens can be eliminated in this way.

Identification of trade-offs—Some emissions can only be reduced at the expense of increasing others. Clearly a cautious approach to emission control is necessary in these cases.

Improvement options/criteria—Reduction of some emissions will clearly not increase others, e.g., increased energy efficiency, reduction of materials waste, better containment. These measures are easy to justify.

Cost/benefit analysis—Having numerical data for the size of key emissions, and the relative contribution of subsystems, allows a manager to carry out a cost/benefit analysis.

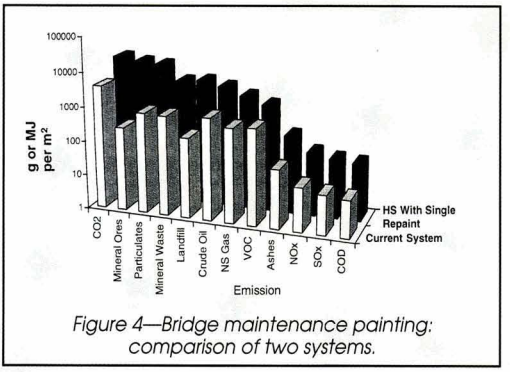

Figure 4—Bridge maintenance painting: comparison of two systems.

Environmentally Based Performance Criteria

An LCA study can result in criteria or hurdles that a new technology must meet to match or improve existing systems. An interesting example of this comes from a study on maintenance painting for the bridge over the Humber Estuary.

Currently, the maintenance engineers use a chloroprene rubber, high VOC coating system that has high performance and is showing little sign of deterioration after 18 years. It has the additional, if not key, advantage of being easy to repair through patching by the ability of the wet paint to cut into the existing film with very good adhesion. The overriding factors were found to be:

- Coating lifetime: Long life reduces the frequency of application and consequently environmental burdens from paint manufacture;
- Long life reduces the frequency of removal of the old coating, reducing the amount of grit used and lost to the environment, along with old paint solids; and
- Repairability: Continuous repair of small patches by roller application with minimal paint removal minimizes both paint and grit used.

If a coating is not patchable, then the whole coating needs to be removed, and to minimize cost and corrosion the new one must be spray-applied with considerable losses of wet paint and grit on an exposed site.

Figure 4 compares some burdens from continuing to use the current system (almost indefinitely with a continuous patching repair strategy) with a high-solids system requiring an initial removal of the old paint, thereafter being patchable. No water-based system has yet been identified with performance characteristics close to the required level.

Accordingly, the bridge engineers now have a feel for the relative emissions, at least in terms of their numerical size and what the environmental consequences are of failing to meet the current level of performance.

Just one stripping and repainting operation adds enormously to the burdens on the environment and sub-element (activity) defines the environmental performance requirements. These are:

- Easily repaired system (patchable);
- Long service life (≥ 25 years); and
- Overcoatable without removal of the old paint to counteract erosion

Environmental Convergence

In the automotive study already referred to,[5] there was a group of emissions that related just to the manufacture of organic materials. In a sensitivity analysis, it was clear that many of these emissions would cease to be significantly different if the solids levels were raised for both high solids and water-based systems. This convergence is likely to be general since it is a reflection of two factors: (1) at higher solids levels both

systems lie on the flatter (and lower) part of the curve in *Figure* 1 so their VOC performance is similar; and (2) the difference in the relative contributions of the organic solvent to the total organic content (solvent + binder) is also smaller, as the solids level is raised.

Particularly in view of other (e.g., energy related) trade-offs that occur, it is important that high-solids systems should not be seen as a stop-gap measure on the way to ever lower VOC coatings; instead they should be viewed as an attractive and viable long term solution in their own right, when other control options (such as end of pipe abatement) are not more economically attractive.

Conclusions

Coating systems are very complex and LCA studies require careful setting up. Definition of the functional unit in terms of articles or coated area, with statements on performance (including durability) is necessary.

- A systems approach is preferred, which takes account of multiple coats, and pre and post treatments (e.g., in service replacement/repair).
- A fair basis for comparison is needed for a credible study, attention must be given to data quality issues.
- Emissions are best grouped according to major contributory cause (subsystem/process).
- Where trade-offs are identified, emission control options are difficult to justify and need to be approached with caution.
- Steps taken to reduce certain emissions will not increase others, e.g., containment; these changes are easy to justify.
- Environmental burdens from high-solids and water based coatings tend to converge as solids levels increase, differences become less significant.
- Cost benefit analysis indicates that high solids systems should be seen as an end-point technology, not as a stop-gap.

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In 1985, Dr. Hazel joined BP Chemicals and moved to Oxygenated Solvents Technical Service in 1991. He has been working on environmentally driven changes in coating technologies across all industrial sectors.

Dr. Hazel has since embarked on life cycle assessment (LCA) and is currently LCA Issues Manager for BP Chemicals' Oxygenated Solvents Business.

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Alex Alessandrini has joined the staff of Daniel Products Co., Jersey City, NJ, as Western Region Sales Manager. Mr. Alessandrini will provide technical support of the agents/distributors and clients in the Western region. He was previously employed by Hilton-Davis. Mr. Alessandrini is a member of the Los Angeles Society.

Four executives of PPG Industries Inc., Pittsburgh, PA, have received new assignments: **Donald W. Bogus** was named Vice President of Industrial Coatings; **Thomas M. Von Lehman** was appointed Vice President of Specialty Chemicals; **Michael A. Ludlow** was named Vice President of Purchasing and Distribution; and **Ernest A. Hahn** was named Vice President of Automotive Original Equipment Glass Products.

Richard W. Brotzman, Jr., has accepted the position of Vice President, Research, for Nanophase Technologies Corporation, Burr Ridge, IL. Dr. Brotzman will be responsible for the company's market and customer applications research and development programs.

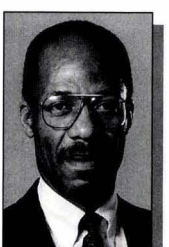
Jorge Seuc has been promoted to the position of Southwestern Regional Sales Manager for Sun Chemical, Cincinnati, OH. Mr. Seuc will be responsible for the company's colorant sales in Texas, Mexico, and Southern California.

Bill Weller has been promoted to Senior Product Manager—Heating for Pillar Industries, Menomonee Falls, WI. Mr. Weller will focus on expanding the application of the company's products into the mass heating customer base.

Following the reorganization of ABB Flexible Automation Inc., New Berlin, WI, **Joseph Carney** was named President of the company's Automotive Systems Division.

In addition, **Silas Nichols** was named President of the company's Products and General Industry Systems.

J. Carney



S. Nichols

Scott Walter to Serve as National Sales Rep for JCT and FSCT Publications

The Federation of Societies for Coatings Technology is pleased to announce that it has retained the services of **Scott Walter** to serve as its National Advertising Representative. Scott will use his sales and publishing expertise to promote advertising opportunities for all FSCT publications, including the JOURNAL OF COATINGS TECHNOLOGY, the FSCT *Year Book*, the International Coatings Expo *Convention Guide*, the Pan-American *Show Guide*, as well as the JCT *Buyers' Guide*.

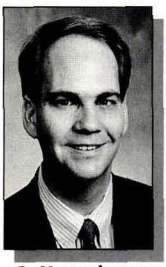
Scott was the National Sales Manager with *Modern Paint & Coatings* for the past two years. Prior to that, he was associated with *Paint & Coatings Industry* as National Sales Manager for several years. Scott's 20 years of publishing experience and 10 years in the paint industry will be a valuable asset to the JCT advertising efforts.

For information on advertising, contact Scott at 22785 Cass Ave., Woodland Hills, CA 91364; (818) 224-3226; Fax: (818) 222-0194.

Chris Vidoli has accepted the promotion to National Sales Manager for OMG Americas, Cleveland, OH. In his new position, Mr. Vidoli will direct the company's sales force and marketing, evaluate new market opportunities, formulate sales strategies, and will coordinate R&D and Applied Technology activities on a worldwide basis.

Todd Montgomery has assumed the title and responsibilities of Manager of Technical Service for Seibert Oxidermo, Romulus, MI. Mr. Montgomery will be responsible for the company's technical service program to optimize customer application of paint products.

Also, **Gary Byrd** joined the staff as Plant Manager, Romulus and Detroit.


G. Hertenberger

Hüls America Inc., Somerset, NJ, has promoted **Greg Hertenberger** to Marketing Manager for the company's Industrial Biocides. In his new position, Mr. Hertenberger will develop and implement business strategies.

The Society of Manufacturing Engineers (SME), Dearborn, MI, has selected the following individuals to join the SME College of Fellows, Class of 1996: **Barbara M. Fossum**, University of Texas, Austin, TX; **Mikell P. Groover**, Lehigh University, Bethlehem, PA; **James C. Leslie**, Advanced Composite Products and Technology, Inc., Huntington Beach, CA; **Frank H. McCarty**, Eliot & Carr Associates, Inc., Parsippany, NJ; **Behnam B. Malakooti**, Case Western Reserve University, Cleveland, OH; **Louis M. Papp**, Manufacturing Advisory Services, Oak Park, MI; **Ali M. Sadegh**, the City College of the City University of New York; **Cecil W. Schneider**, Lockheed Martin Aeronautical Systems, Marietta, GA; **A. Galip Ulsoy**, of University of Michigan, Ann Arbor, MI; and **Richard A. Wysk**, of Pennsylvania State University, University Park, PA.

Cook Composites and Polymers, Kansas City, MO, has announced the following two new executive management appointments within the company: **Paul Schaefer** was named Vice President of Operations and **Eric (Rick) Naimark** was named CCP's Vice President of Purchasing.

Gail J. Hauptfuhrer has joined the staff of ICI Surfactants Household Business, Wilmington, DE, as National Accounts Manager. Ms. Hauptfuhrer is charged with leading the company's business efforts.

In addition, **Karin M. Popov** was named Market Development Manager. Ms. Popov will develop and implement marketing plans for products within the Household Business.

Environmental Resources Management (ERM), Exton, PA, has named **Kenneth N. Weiss** as Operations Manager. Mr. Weiss will direct business operations for the site remediation, management consulting, facility services and technical services departments.

In addition, **T. Neil Peters** was appointed Manager of Site Remediation. In this capacity Mr. Peters will manage the new site remediation department, which integrates engineering, geoscience and risk assessment capabilities.


R. Stober

Degussa Corp., Ridgefield Park, NJ, has named **Reinhard Stober** to the position of Vice President of Research, Development and Applied Technology for Rubber Chemicals and Pigments. Dr. Stober will guide research, development and applied technology activities.

LaserMike, Inc., Dayton, OH, has appointed **Stuart Manser** as Regional Sales Manager for the western California area, which includes California and Arizona.

Green Stuff® Absorbent Products, Inc., Cuyahoga Falls, OH, has appointed **A. Blaine Hinds** to the position of Technical Sales Representative for the company's Eastern Region. Mr. Hinds will assist industrial waste generators and spill response teams.

C. Brandt Ryan was named Technical Sales Representative for the company's Western Region. Mr. Ryan is charged with marketing Green Stuff absorbent products.

Also, **Tracy Boulware** was named Technical Sales Representative for the Central United States. Ms. Boulware will work with industrial waste generators and spill response teams in North and South Dakota, Minnesota, Nebraska, Iowa, Kansas, Missouri, New Mexico, Texas, Oklahoma, Arkansas, and Louisiana.


P.M. Ryan

Engelhard Corp., Iselin, NJ, has appointed **Patrick M. Ryan** to the post of Manager, Field Service Operations for its Process Emissions Systems business. Mr. Ryan will provide support for the company's customers in the automotive, pulp and paper, printing and CPI industries.

Etna Products, Inc., Chagrin Falls, OH, has named two new Vice Presidents. **John C. Steigerwald** has joined the company as Vice President, Business Development. He will plan and direct business development in North America and Europe with respect to sales, marketing, research and development and technical service management.

Also, **Tom LaPlante** was promoted to Vice President of Manufacturing. Mr. LaPlante will plan and control the entire range of manufacturing activities for the company.

In addition, **Troy D. Carr** was appointed to the position of Sales Engineer for its line of metalworking lubricants, rust preventatives, and other related products and services.

Jeff O'Neill has been named Vice President and General Manager of Harcros Organics, Kansas City, KS. Prior to joining Harcros Chemicals, Mr. O'Neill was Marketing Manager for Harcros Pigments.


P.W. Stewart

Peter W. Stewart has joined the staff of Witco Corp., Greenwich, CT, as a Market Manager in the Olefins/Styrenics strategic business unit of the Polymer Additives Group. Mr. Stewart's primary responsibilities include the polymer lubricants, antistatic agents, and antioxidants portions of the Olefins/Styrenics business.

In addition, **Frances J. Bender** has accepted the position of Assistant Manager of the company's Public Relations Department. Ms. Bender will be responsible for the internal communications and support for Witco's community, financial, and media relations efforts.

Elsewhere, **Camillo J. DiFrancesco** was named Chief Financial Officer-designate upon the resignation of **Michael D. Fullwood**.

Raw Materials

Adhesion Promoters

Chartwell International, Inc., announces two proprietary metal organic adhesion promoters with primary and secondary amine functionality. Chartwell B-516.5W, synthesized in water and supplied at a pH of 8.1, and Chartwell B-516.5, synthesized in ethylene glycol and supplied at a pH of 8.8, are compatible when directly added to most latex and waterborne polymers. Both adhesion promoters are designed for use in inks, adhesives, and industrial coatings to improve adhesion to various metal substrates and plastic films.

Circle No. 30 on Reader Service Card

Additives

MFA 31, a mega flow additive for waterborne and water-reducible trade sales and industrial coatings systems, is available from PCI Group, Inc. This nonionic, recoatable additive reportedly increases flow, thereby enhancing the gloss. MFA 31 is designed to eliminate surface defects such as pinholes, fisheyes, and craters through flow and substrate wetting.

Circle No. 31 on Reader Service Card

Color Concentrates

Lancer Dispersions introduces a new line of VynTek™ color concentrates designed for PVC compounders and processors. The VynTek color series includes concentrates based on yellow iron oxide, red iron oxide, carbon black, and titanium dioxide and are designed for applications where a color match has not been indicated. The VynTek™ line is manufactured according to ISO-9002 certification.

Circle No. 32 on Reader Service Card

Paints/ Coatings

Latex Paint

Velsicol Chemical Corp. introduces a benzoate derivative, Velate® 262, that is an alternative to the alcohol/ester based coalescent in latex paints that produces a lasting odor. Velate 262 produces a nonpungent odor that reportedly dissipates in less than two hours. The physical properties of latex paint formulations that use Velate 262 compare to those in many of the standard latex paints.

Circle No. 33 on Reader Service Card

Adhesive Resin

Cabot Stains introduces Cabot® Finish, a 100% acrylic, low luster finish for use on trim and siding surfaces. Cabot Finish is an adhesive resin designed to recoat surfaces such as gutters, shutters, railings, downspouts, and doors without priming or sanding. This resin brushes on, dries quickly, cleans up with soap and water, and provides color retention. When applied according to the directions, Cabot Finish is guaranteed not to crack, peel, or blister for 15 years.

Circle No. 34 on Reader Service Card

Pre-Prime

Sherwin-Williams Industrial and Marine Coatings announces Macropoxy® 920 Pre-Prime. The new pre-primer enhances the macropoxy line of high-solids, VOC compliant coatings, and provides industrial customers with a bonding basecoat on structures that cannot be prepared through abrasive cleaning. Macropoxy 920 Pre-Prime is designed for use over many substrates including masonry and poured concrete, galvanized steel, marginally prepared steel, and "white rusted" zinc rich coatings.

Circle No. 35 on Reader Service Card

Testing Equipment

Bubble Viscometer

BYK-Gardner USA introduces a complete line of viscosity measuring products including bubble viscometers. The bubble viscometer measures kinematic viscosity by the rate at which bubbles rise. The viscosity of a liquid sealed in a standard tube is stable, and the tubes have no orifices that can become clogged or damaged to cause inaccurate readings. The bubble viscometers conform to ASTM Methods D 1131, 1545, and 1725.

Circle No. 36 on Reader Service Card

Accelerated Weathering Tester

Q-Panel Lab Products introduces the QUV/spray. The new QUV accelerated weathering tester features a spray system in addition to the condensation system. Water spray can be combined with condensation to enhance outdoor results. The QUV/spray may be set to produce short spray cycles for thermal shock or long spray cycles for mechanical erosion. This accelerated weathering tester may be operated as UV alone, spray alone, or condensation or as a typical QUV tester.

Circle No. 37 on Reader Service Card

Digital Temperature Controller

Athena Controls, Inc., introduces the Series OTC-25, a microprocessor-based 1/4 DIN panel-mounted digital temperature controller. The Series OTC-25 is available in on/off, limit controller, or PID versions. This unit offers ± 0.3% FS accuracy and a 0.56 in. LED window that is user selectable to display process temperature or setpoint. The temperature controller is mounted in a NEMA 4X front bezel and accepts input from Type J thermocouples. The Series OTC-25 includes CE, cUL, and UL approvals.

Circle No. 38 on Reader Service Card

Equipment

Injection Manifold

New from Charles Ross & Son Company is a solid/liquid injection manifold (SLIM). SLIM injects solids and liquids into the high shear mix zone of a rotor/stator mixer, but it does not rely on the natural flow of the mixer to gradually draw liquids and solids into the mix and the high shear zone. For additions that are difficult to introduce, i.e., natural and synthetic gums, concentrated pigments, fumed silica, the SLIM system reportedly decreases the time of the mixing cycles, and no time is wasted while these solids float on the surface.

Circle No. 39 on Reader Service Card

Blast Gun

An ergonomically designed blasting gun, RS-2000, is developed by Boride Products, Inc. The RS-2000 features an oversized, rounded thumb opening and thick palm grip to accommodate protective gloves. The boron carbide nozzle/tungsten carbide air jet cartridge is designed to increase service life and make replacing parts easier with less chance for misalignment. The RS-2000 comes with fittings to adapt to many blasting systems and is available in right- and left-handed models.

Circle No. 40 on Reader Service Card

Rechargeable Spray Container

Reference Products Ltd. introduces the RF rechargeable spray container, an aluminum pressure canister with a screwed valve unit. Among the accessories available is a polypropylene pistol-grip handle that clips onto the valve body and has no trailing hoses. This spray container is manufactured to EN 20090 and designed to withstand 18 bar pressure.

Circle No. 41 on Reader Service Card

Misc. Miscellaneous

Hazardous Waste Labels

Labelmaster announces a hazardous waste laser label. The labels are 6 in. X 6 in. printed on 8 1/2 in. X 11 in. laser sheet that rolls through a laser printer. The labels are printed with fade and chemical resistant ink on film material designed to withstand exposure to the elements and are backed with an adhesive.

Circle No. 42 on Reader Service Card

Screw Covers

Resistance temperature detectors (RTD) from Tudor Technology, Ltd., are available with a choice of screw cover head types. RTD probes consist of a fine diameter platinum circuit embedded in ceramic and encased in a stainless steel sheath. The probes may be ordered with 2, 3, or 4 leads that range from 100 to 1000 ohms and range in temperature to 500°, 900°, or 1200°F.

Circle No. 43 on Reader Service Card

Open Head Drums

Sonoco Products Co., Industrial Container Div., introduces two open head plastic drums for shipping and storing hazardous liquids and solids, the OT-55 and OC-210. The OT-55 is a straight sided, 55-gallon container that complies with DOT/UN regulations and carries a Y1.5/100 rating for shipping liquid and solid hazardous materials; the OC-210 is a tapered, 210 liter container that carries a Y400/S rating for shipping and storing solid material.

Circle No. 44 on Reader Service Card

Dust Collectors

Micro Air introduces a cartridge type dust collector engineered to be functional in every size range. These dust collectors have the Roto-Pulse™ cartridge cleaning system that automatically cleans the filter cartridges. Maintenance is quick because of the accessibility to all components. The dust collector is available in four, six, and eight cartridge models with ratings from 1000 to 6000 CFM.

Circle No. 45 on Reader Service Card

Blow-Molded Drum Liner

CDF announces a smooth-walled liner for 55 gallon, open-head drums with a 21.5 in. diameter. The liner is made from FDA-approved, LDPE with an average wall thickness of 15 mils. This blow-molded liner has an ultra thin lip that is designed to prevent leakage between the insert and drum. By using inserts and liners, companies are able to recycle, reuse, or recondition their drums.

Circle No. 46 on Reader Service Card

Haz Mat Storage

New from the Precision Quincy Corp. are large portable buildings for storing hazardous materials. The buildings are available in sizes up to 1400 sq. ft. and with fire ratings of either two or four hours. All welded steel units include an under floor containment sump; other options include HVAC, insulation, a variety of alarm and fire systems, and lighting.

Circle No. 47 on Reader Service Card

Chemical Removal

Peel Away 5®, a product that removes high strength chemically resistant floor coatings, is available from Dumond Chemicals, Inc. Peel Away 5 is designed to remove industrial strength coatings from flooring substrates without affecting the substrate. Peel Away 5 is free of methylene chloride, MEK, and other flammable solvents. This solvent is available in a gel to offer a range of application options.

Circle No. 48 on Reader Service Card

Stretch Film

Stretch-O-Seal Corp. introduces a stretch wrap machine that applies stretch film under tension to multiple containers. This film holds the containers securely so they can be palletized without boxes or corrugated, in many cases. The machine can reportedly bundle two, three, or four round containers and up to 12 square or rectangular containers ranging from one pint to three gallons. Clear film allows visual inspection of the product.

Circle No. 49 on Reader Service Card

Federation Meetings

For information on FSCT meetings, contact Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422 (610) 940-0777, FAX: (610) 940-0292.

1996

(Oct. 22-24)—International Coatings Technology Conference. Chicago Hilton and Towers and McCormick Place North, Chicago, IL.

(Oct. 23-25)—FSCT Annual Meeting and International Coatings Expo (Formerly Annual Meeting and Paint Industries' Show). McCormick Place North, Chicago, IL.

1997

(May 17-18)—FSCT Spring Board of Directors Meeting. May 17—Social Tour; May 18—Board Meeting. Hyatt Regency, Birmingham, England.

(June 20-21)—FSCT Incoming Society Officers Meeting. June 20—FSCT Headquarters Visit, Meeting, and Reception; June 21—Society Officers Meeting. Marriott West, Conshohocken, PA.

(Nov. 3-5)—FSCT Annual Meeting and International Coatings Technology Conference and Expo (Formerly Annual Meeting and Paint Industries' Show). Georgia World Congress Center, Atlanta, GA.

Special Society Meetings

1997

(Feb. 5-7)—24th Annual International Waterborne, High-Solids, and Powder Coatings Symposium. Sponsored by the Southern Society and The University of Southern Mississippi (USM). New Orleans, LA. (Robson F. Storey or Shelby F. Thames, Co-Organizers, WBHS&PC Symposium, Dept. of Polymer Science, USM, Box 10076, Hattiesburg, MS 39406-0076).

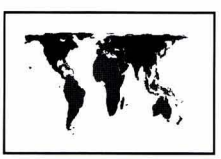
(Feb. 18-20)—Western Coatings Societies' 23rd Biennial Symposium and Show. Sponsored by the Golden Gate, Los Angeles, Pacific Northwest, and Rocky Mountain Societies. Disneyland Hotel and Convention Center, Anaheim, CA. (Robert J. Skarvan, EPS, Inc., 5501 E. Slauson Ave., Los Angeles, CA 90040; (800) 642-7077or for exhibit space: Roberta Garcia, ICI Paints, 6100 S. Garfield Ave., Los Angeles, CA 90040; (213) 888-8888, ext. 8343).

(May 8-10)—50th Annual Spring Symposium. Sponsored by the Pacific Northwest Society. Pan-Pacific Hotel, Vancouver, British Columbia. (Kelvin J. Huget, Imasco Minerals Inc., 19287-98A Ave., Surrey, B.C. V4N 4C8; (604) 888-3848; fax: (604) 888-5671).

(May 12-14)—Southern Society Annual Meeting. King and Prince Beach and Golf Resort, St. Simons Island, GA. (Eve Irvine, J.M. Huber Corp., One Huber Rd., Macon, GA 31298; (912) 750-5433).

Other Organizations

1996—North America



(Oct. 20-23)—"Polyurethanes Expo '96." Technical Conference & Exposition sponsored by The Society of the Plastics Industry, Inc., (SPI). Bally's Las Vegas Casino and Hotel, Las Vegas, NV. (SPI, Polyurethane Division, 355 Lexington Ave., New York, NY 10017).

(Oct. 23-25)—109th Annual Meeting of the National Paint and Coatings Association (NPCA). Palmer House (Hilton), Chicago, IL. (Cheryl Matthews, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005-5597).

(Oct. 27-Nov. 1)—84th Congress & Exposition. Sponsored by the National Safety Council. Orange County Convention Center, Orlando, FL. (Michael J. Taylor, National Safety Council, 1121 Spring Lake Dr., Itasca, IL 60143-3201).

(Oct. 28-29)—"Set-Up Reduction—How to Apply Innovative Just-In-Time Techniques to Shrink Lot Sizes, Slash Lead Times, and Maximize Competitiveness." Sponsored by The Saddle Island Institute. Radisson Plaza Hotel at Kalamazoo Center, Kalamazoo, MI. (Betsy Tyson, The Saddle Island Institute, 100 State St., Boston, MA 02109).

(Oct. 28-30)—"The Fundamentals of Corrosion and Its Control." Sponsored by LaQue Corrosion Services. Holiday Inn SunSpree Resort, Wrightsville Beach, NC. (S. Darden, LaQue Corrosion Services, P.O. Box 656, Wrightsville Beach, NC 28480).

(Oct. 29-31)—Fabtech West Conference & Exposition. Sponsored by the Society of Manufacturing Engineers (SME). San Jose Convention Center, San Jose, CA. (SME, One SME Drive, P.O. Box 930, Dearborn, MI 48121-0930).

(Nov. 1-3)—"Fall Decor '96: Paint and Decorating Show." Sponsored by the National Decorating Products Association (NDPA). Minneapolis Convention Center, Minneapolis, MN. (Teri Flotron, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

(Nov. 3-6)—1996 International Conference. Sponsored by the Adhesive and Sealant Council, Inc. Fairmont Atop Nob Hill, San Francisco, CA. (Kathy Oates Domenick, Director, Education and Training, The Adhesive and Sealant Council, Inc., 1627 K St., N.W., Ste. 1000, Washington, D.C. 20006).

(Nov. 4-6)—"Particle Size Analysis." Training course sponsored by Horiba Instruments, Irvine, CA. (Geneen Spence, Horiba Instruments, 17671 Armstrong Ave., Irvine, CA 92714).

(Nov. 6-7)—"Paint Volatile Organic Compounds (VOCs)." Training course sponsored by the American Society for Testing and Materi-

als (ASTM). Los Angeles, CA. (Kristina Falkenstein, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959).

(Nov. 6-8)—ARMA Executive Committee Meeting and Board of Directors Meeting. Sponsored by Asphalt Roofing Manufacturers Association (ARMA). Tucson, AZ. (ARMA, 6000 Executive Blvd., Ste. 201, Rockville, MD 20852-3803).

(Nov. 10-13)—"Organic Coatings Science and Technology." Sponsored by the State University of New York, Institute of Materials Science and the Division of Polymeric Materials: Science and Engineering of the American Chemical Society (ACS). Westin Resort, Hilton Head Island, SC. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Nov. 10-15)—Annual Meeting of the American Institute of Chemical Engineers. Sponsored by American Institute of Chemical Engineers. Palmer House Hilton, Chicago, IL. (AIChE*xpress* Service Center, 345 E. 47th St., New York, NY 10017-2395).

(Nov. 11-13)—"Surface Treatment of Plastics: Technology and Applications." Seminar sponsored by Technomic Publishing Co., Inc. The Back Bay Hilton Hotel, Boston, MA. (Program Division: Technomic Publishing Co., Inc., 851 New Holland Ave., Box 3535, Lancaster, PA 17604).

(Nov. 12-14)—Autofact Conference & Exposition. Sponsored by the Society of Manufacturing Engineers (SME). Cobo Center, Detroit, MI. (SME, One SME Drive, P.O. Box 930, Dearborn, MI 48121-0930).

(Nov. 17-21)—SSPC '96. 1996 International Conference and Exhibition. Charlotte, NC. (Dee Boyle, SSPC, 40 24th St., 6th Floor, Pittsburgh, PA 15222-4643).

(Nov. 19-22)—"The Fourth Color Imaging Conference: Color Science, Systems, and Applications." Sponsored by the Society for Imaging Science & Technology (IS&T) and the Society for Information Display (SID). The Radisson Resort, Scottsdale, AZ. (IS&T, 7003 Kilworth Lane, Springfield, VA 22151; or SID, 1526 Brookhollow Dr., Ste. 82, Santa Ana, CA 92705).

(Nov. 25-26)—Thomas Show. Sponsored by Thomas Scientific. Renaissance Harborplace Hotel, Baltimore, MD. (Thomas Scientific, 99 High Hill Rd. at I-295, Swedesboro, NJ 08085-0099).

1997—North America

(Jan. 20-22)—"Composites '97 Manufacturing & Tooling." Conference and Exhibition sponsored by Society of Manufacturing Engineers (SME). Marriott, Anaheim, CA. (SME Customer Service, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930).

(Jan. 21-24)—"Environmentally Compliant Coatings." Short course sponsored by North Dakota State University (NDSU). Crowne Plaza Resort, Hilton Head Island, SC. (Debbie Shasky, Program Coordinator, NDSU, Dept. of Polymers and Coatings, 54 Dunbar Hall, Fargo, ND 58105).

(Jan. 28)—PCI Technical Subcommittee on Test Methods and ASTM D01.51 on Powder Coatings. Sponsored by the American Society for Testing and Materials (ASTM). Embassy Suites, Ft. Lauderdale, FL. (Jeffrey Hagerlin, O'Brien Powder Products, 9800 Genard Rd., Houston, TX 77041-7624).

(Feb. 14-15)—"Spring Decor '97: Paint & Decorating Show." Sponsored by the National Decorating Products Association (NDPA). Charlotte Convention Center, Charlotte, NC. (Teri Flotron, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

(Feb. 22-24)—"Interiors Decor Showcase '97." Sponsored by the National Decorating Products Association (NDPA). Toronto Congress Centre, Toronto, Ontario, Canada. (Teri Flotron, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

(Feb. 24-26)—"Basic Coatings for Sales, Marketing, and General Personnel." Short Course sponsored by University of Missouri-Rolla (UMR), St. Louis, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409).

(Mar. 1-2)—"Degradation and Stabilization of Polymers." Sponsored by the State University of New York. Hilton Head Island, SC. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Mar. 3-5)—"Polymer Stabilizers and Modifiers '97: Conference and Exhibit." Sponsored by the State University of New York, Institute of Materials Science and the Division of Polymeric Materials: Science and Engineering of the American Chemical Society (ACS). Hilton Head Island, SC. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Mar. 10-12)—"Introduction to Polymer Colloids/Emulsion Polymers." Sponsored by the State University of New York. Hilton Head Island, SC. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Mar. 10-13)—"Pigment Dispersions: Science and Technology." Sponsored by the State University of New York. Hilton Head Island, SC. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Apr. 7-10)—12th Annual Advanced Composites Conference and Exposition. Sponsored by The Engineering Society (ESD) and SAE International. Westin Hotel, Renaissance Center, Detroit, MI. (Wael Berrached, ESD, 29355 Northwestern Hwy., Ste. 200, Southfield, MI 48034).

(Apr. 7-11)—"Basic Composition of Coatings." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409).

(Apr. 8-10)—Sixth Annual Advanced Coatings Technology Conference & Exposition. Sponsored by The Engineering Society (ESD) and SAE International. Westin Hotel, Renaissance Center, Detroit, MI. (Wael Berrached, ESD, 29355 Northwestern Hwy., Ste. 200, Southfield, MI 48034).

(Apr. 21-24)—"Introduction to Paint Formulation." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409).

(Apr. 23-26)—"Coverings '97." Flooring exhibition sponsored by TSI, Inc. Orange County Convention Center, Orlando, FL. (Coverings, 900 E. Indiantown Rd., Ste. 207, Jupiter, FL 33477).

(May 1-2)—"Paint Volatile Organic Compounds (VOCs)." Training course sponsored by the American Society for Testing and Materials (ASTM). Chicago, IL. (Kristina Falkenstein, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959).

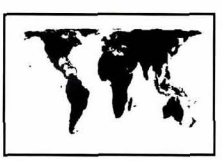
(May 7-9)—"Adhesive and Coating Adhesion." Sponsored by the State University of New York. Orlando, FL. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(May 7-9)—"Block and Graft Copolymer Blends." Sponsored by the State University of New York. Orlando, FL. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(May 19-23)—"Physical Testing of Paints & Coatings." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409-0010).

(June 2-6)—"Advances in Emulsion Polymerization and Latex Technology." Short course sponsored by Lehigh University. Emulsion Polymers Institute, Bethlehem, PA. (Mohamed S. El-Aasser, Emulsion Polymers Institute, Lehigh University, 111 Research Dr., Bethlehem, PA 18015).

1996—Asia



(Nov. 5-8)—Technomart '96. Co-sponsored by Korea Institute of Industry and Technology Information and ARAC, Inc. Seoul, Korea. (Louise de Sinety, ARAC, Inc., 23 N. Main St., Ste. C, Franklin, IN 46131).

1997—Asia

(Mar. 9-11)—India International Coatings Show '97. Sponsored by FMJ International Publications Ltd. World Trade Centre, Bombay, India. (Jane Malcolm-Coe, PR & Publicity Dept., FMJ International Publications Ltd., Queensway House, 2 Queens-way, Redhill, Surrey, RH1 1QS, England).

(Oct. 22-24)—"New Developments in Colour Material Science and Technology." 70th Anniversary Conference on Colour Materials Tokyo sponsored by the Japan Society of Colour Material. Arcadia Ichigaya (Shigaku Kaikan), Tokyo, Japan. (Shuichi

Hamada, Japan Society of Colour Material, Kitamura Bldg. 5F, 9-12, 2-chome, Iwamoto-cho, Chiyoda-ku, Tokyo 101, Japan).

1996—Europe

(Nov. 4-5)—The Sixth Annual Conference on Textile Coating and Laminating. Sponsored by the *Journal of Coated Fabrics*. Dusseldorf Hilton Hotel, Dusseldorf, Germany. (Programme Division: Technomic Publishing AG, Missionstrasse 44, Ch-4055 Basel, Switzerland).

(Nov. 11-13)—"Waterborne, High-Solids, & Radcure Technologies." Sponsored by Paint Research Association. Frankfurt, Germany. (Conference Secretary, Paint Research Association, 8 Waldegrave Rd., Teddington, Middlesex, TW11 8LD England).

(Nov. 12-14)—"Resins & Pigments." Exhibition and Conference sponsored by FMJ International. Frankfurt Messe, Frankfurt am Main, Germany. (Jane Malcolm-Coe, FMJ International Publications Ltd., Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England).

(Nov. 26-27)—"Forum de la Connaissance 1996." Sponsored by the Association Française des Techniciens des Peintures, Vernis, Encres d'imprimerie, Colles et Adhésifs (AFTPVA). Auditorium de la Tour ELF, Paris-la-Défense, France. (AFTPVA, rue Etex, F-75018 Paris, France).

1997—Europe

(Feb. 3-5)—"Co-Mold '97." Sponsored by Maack Business Services. Zürich, Switzerland. (Maack Business Services, Moosacherstrasse 14, CH-8804 AU/Zürich, Switzerland).

(Apr. 8-10)—European Coatings Show '97. Exhibition and conference sponsored by Vincentz Verlag. Nürnberg, Germany. (Vincentz Verlag, Postfach 6247, D-30062 Hannover, Germany).

(Apr. 14-19)—Hannover Fair '97. Industrial fair sponsored by Hannover Fairs USA, Inc. Hannover Fairgrounds, Hannover, Germany. (Andrea Anderson, Project Director, Hannover Fairs USA, Inc., 103 Carnegie Center, Princeton, NJ 08540).

(May 6-7)—"PE '97." Sponsored by Maack Business Services. Milano, Italy. (Maack Business Services, Moosacherstrasse 14, CH-8804 AU/Zürich, Switzerland).

(May 12-14)—"Epoxy Technologies for Ambient Cure Protective Coatings." Sponsored by Paint Research Association. Brussels, Belgium. (Conference Secretary, Paint Research Association, 8 Waldegrave Rd., Teddington, Middlesex, TW11 8LD England).

(May 29-June 1)—15th SLF-Congress. Sponsored by the Skandinaviska Lackteknikers Förbund (SLF). Lillehammer, Norway. (Bent Haflan, Jotun A/S, P.O. Box 2021 Hasle, N-3235 Sandefjord, Norway; or Svein Singstad, Scanox A/S, P.O. Box 42 Ainabru, Norway).

(June 9-11)—19th Annual International Conference on the Degradation and Stabilization of Polymers. Sponsored by the State University of New York. Luzern, Switzerland. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(June 17-20)—International Intensive Short Course on the Science and Technology of Pigment Dispersions. Sponsored by the State University of New York. Luzern, Switzerland. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

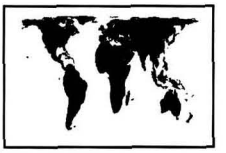
(July 7-11)—23rd Annual International Conference on Organic Coatings: Waterborne, High-Solids, and Powdered Coatings. Sponsored by the State University of New York. Athens, Greece. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Sept.15-17)—"PP '97." Sponsored by Maack Business Services. Zürich, Switzerland. (Maack Business Services, Moosacherstrasse 14, CH-8804 AU/Zürich, Switzerland).

(Nov. 3-5)—"PET '97." Sponsored by Maack Business Services. Zürich, Switzerland. (Maack Business Services, Moosacherstrasse 14, CH-8804 AU/Zürich, Switzerland).

(Dec. 1-3)—"SP '97." Sponsored by Maack Business Services. Zürich, Switzerland. (Maack Business Services, Moosacherstrasse 14, CH-8804 AU/Zürich, Switzerland).

1997—South America



(Sept. 15-17)—Fifth International Paint Congress and Exhibition on Paint Industry Suppliers. Sponsored by the Brazilian Association of Paint Manufacturers (ABRAFATI). Palacio de Convenções do Anhembi, São Paulo, Brazil. (Congress Organization Secretariat, Específica S/C Ltda., Rua Augusta, 2516-2° andar-cj. 22, 01412-100-São Paulo-SP-Brazil).

Advertisers' Index

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Humbug from Hillman

Lou Eromenok, who claims to be, "friend of the working girl and the woman's home companion," enters our poetry corner this month with:

Adam and Eve leaning against the wall
Wearing not a stitch at all,
Save for the leaf.
Things are bound to happen
When the leaves begin to fall.

My thanks to Tom Shaynock for his encouraging note and his entry into the Burma Shave Recall Society:

Ben met Anna
Made a hit
Didn't shave close
Ben Anna split.

* * * * * * * * *

My respect for Art Tracton knows almost no bounds. Apparently, he comprehends the garbled addressing on the Internet. The introduction to the messages that he sent me under the title of "Light Humor" would even stump Frank Borrelle. To me, that Internet stuff is even more incomprehensible than some of the titles of the JCT articles.

These are a sampling of the "funny" advertisements from assorted newspapers that came through the web (?) or net or (?) or whatever.

—Two female Boston terrier puppies. Seven weeks old. Perfect markings. 555-1234. Leave mess.

—Lost small apricot poodle. Reward. Neutered. Like one of the family.

—A superb and inexpensive restaurant. Fine food expertly served by waitresses in appetizing forms.

—Dinner special—Turkey $2.35; Chicken or Beef $2.25; Children $2.00.

—For sale: an antique desk suitable for lady with thick legs and large drawers.

—Four poster bed, 101 years old. Perfect for antique lover.

—We do not tear your clothing with machinery. We do it carefully by hand.

—Have several very old dresses from grandmother in beautiful condition.

—Tired of cleaning yourself? Let me do it.

There are many more . . . for another time.

* * * * * * * * *

Willy C.P. Busch seems to be an avid reader of Ann Landers' column who seems to specialize in the kind of fractured English that usually can be traced to Richard Lederer's collections. Her correspondent claims, "These are not contrived. They are real." . . . Right!!!

—When you smell an odorless gas, it is carbon monoxide.

—Water is composed of two gins, oxygin and hydrogin. Oxygin is pure gin. Hydrogin is gin and water.

—Nitrogen is not found in Ireland because it is not found in a free state.

—When you breathe, you inspire. When you do not breathe, you expire.

—Three kinds of blood vessels are arteries, vanes, and caterpillars.

—A fossil is an extinct animal. The older it is, the more extinct it is.

Sorry Willy, that's all I could stand.

* * * * * * * * *

Be warned! This time it's about Dick Stewart's cousin.

Dick says that his cousin worked in a brewery. He's dead now. He was walking along a catwalk and slipped and fell into a vat of beer. He drowned.

His widow went to see the foreman to find out what happened. She wanted to find out if her dear departed had suffered very much. "Oh I don't think so," the foreman said. "As a matter of fact, he climbed out three times to go to the bathroom."

* * * * * * * * *

Tireless Bob Athey sent me a load of amusing stuff. I'll feed it to you a bit at a time. For example:

—"I will not eat raw oysters. I want my food dead—not sick—not wounded—dead!"—Woody Allen

—Many a boy or girl at 16 can't possibly believe that someday they will be as dumb as Dad.

—A devoted husband and father is a man who stands by his wife in troubles she wouldn't have had if she hadn't married him.

—Too many people spend the first six days of the week sowing wild oats. . . . then go to church on Sunday and pray for a crop failure.

—Barnes Law: There's a 50% chance of anything . . . either it happens or it doesn't.

—Hellman's Mayonnaise Principle: Keep cool but do not freeze.

—Herb Hillman, Humbug's Nest, P.O. Box 135, Whitingham, VT 05361.

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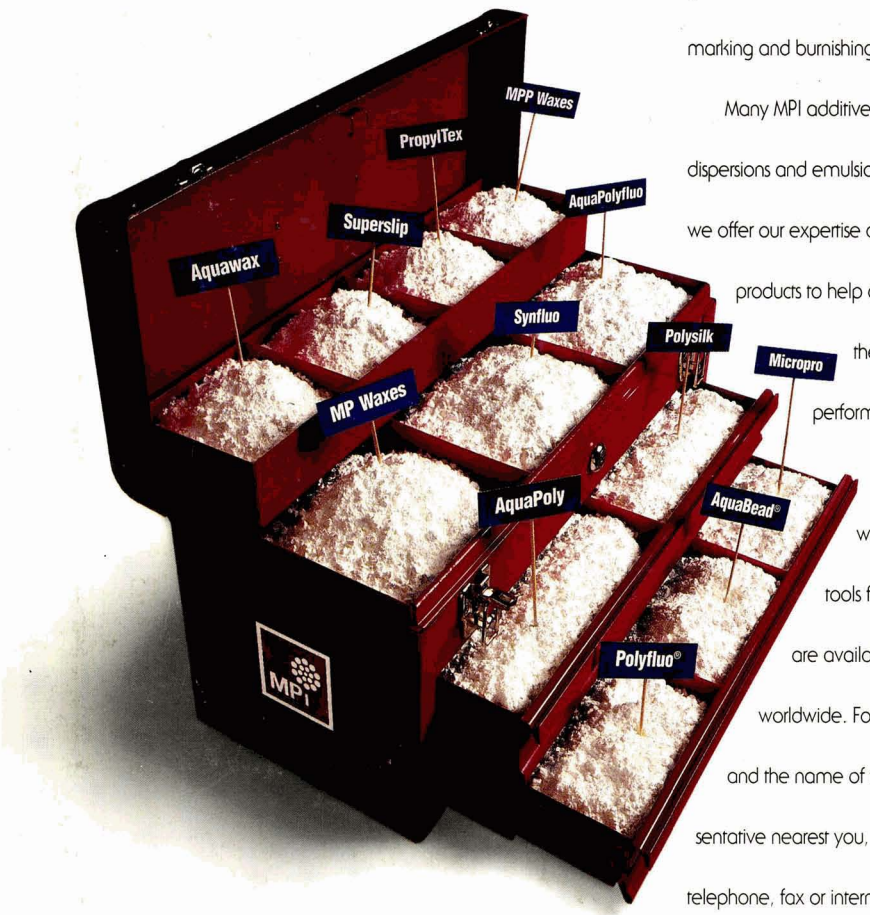

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