

May 1998

JCT

JOURNAL OF COATINGS TECHNOLOGY

**MICROSTRUCTURE OF
WEATHERED PAINT AND ITS
RELATION TO GLOSS LOSS:
COMPUTER SIMULATION
AND MODELING**

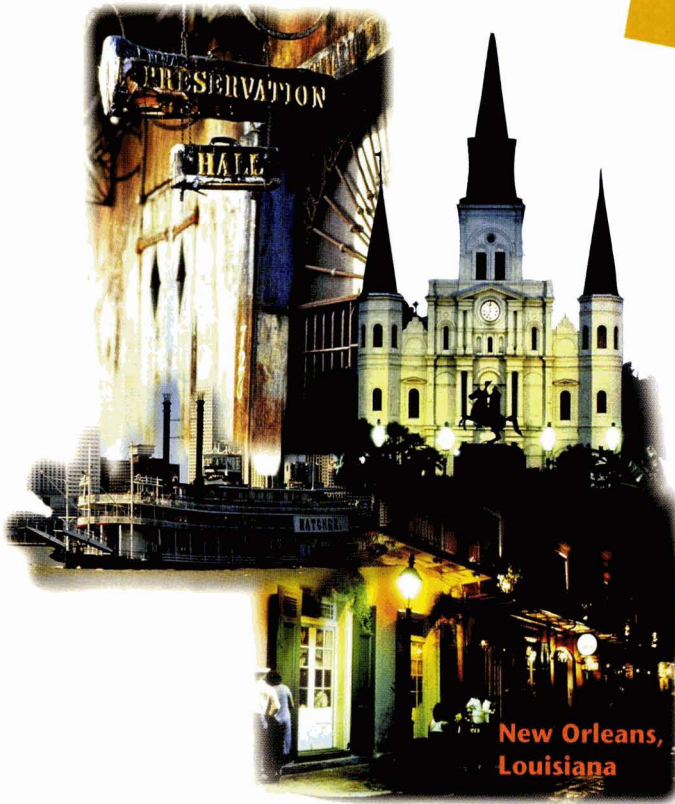
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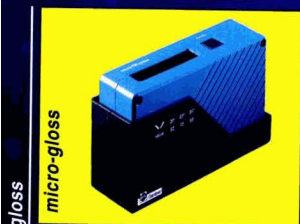
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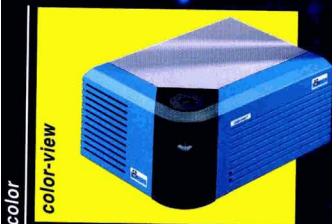
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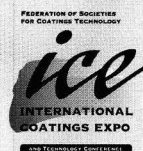
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- 45** Microstructure of Weathered Paint and Its Relation to Gloss Loss: Computer Simulation and Modeling—F.Y. Hunt, M.A. Galler, and J.W. Martin
Events that occur during the weathering of paint films are modeled mathematically. The model predicts previously observed effects of pigmentation—PVC, pigment flocculation/dispersion, pigment particle size distribution—on the surface roughness and gloss of weathered paint films.
- 55** A New Approach in the Development and Testing of Antifouling Paints without Organotin Derivatives—K. Vallee-Rehel et al.
New acrylic resins are synthesized and formulated with antifouling paints. The hydrophilic/hydrophobic character of the resin plays a dominant role in the performance of the paints.
- 65** Photodegradation of Water-Based Acrylic Coatings Containing Silica—A.M. Morrow, N.S. Allen, and M. Edge
The durability of acrylic copolymer systems containing silica as a matting agent is investigated, with particular emphasis on the photodegradation process.
- 73** Novel Ambient Temperature Curable Two-Component Waterborne Silicone-Acrylic Coatings—N. Harui and T. Agawa
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C O M M E N T

Q & A



Recently, the *JCT* conducted its first readership survey. To those who took part, we sincerely appreciate your participation and quick responses. The survey gauged the attention and interest of our member-subscribers to both editorial and advertising published in the February 1998 issue of the *Journal*. We note, with pleasure, the high level of interest in both the technical articles and editorial matter presented.

While this survey was of modest proportions, it did present some interesting findings:

- On a scale of 1-5 (5 = very useful, 1 = not very useful), 69% of respondents ranked *JCT* technical articles 4-5.
- Editorial departments found most useful included: Industry News, New Products, Regulatory Update and Product Overview .
- The areas that attracted—and sustained—the highest reader interest included: Technical Articles, Open Forum Articles, Comment Page, Industry News, Regulatory Update and—not surprisingly—Humbug from Hillman.

A second, more comprehensive survey will be conducted in the near future to further gauge the needs, expectations, and interests of our readers. The information gathered will be used by the Federation's Publications Committee to develop enhancements to the *JCT*.

Meanwhile, at the Federation level, the changes occurring within the FSCT, its expanded activities and increased efforts, have been discussed and reviewed from many perspectives. The Board of Directors and Executive Committee, major FSCT committees, and the Societies' leadership have all presented thoughts and recommendations on where the Federation should be going.

The individual members—those directly affected by these changes—were polled in the past year through a comprehensive statistical survey. This survey covered all areas of the Federation, including topics in education, communication, publications, seminars, and their level of activity.

As we progress, the results of the above surveys will be an important tool for the FSCT leadership and committees in developing specific activities to benefit our membership and the industry.

Robert F. Ziegler
Executive Vice President

Microstructure of Weathered Paint and Its Relation to Gloss Loss: Computer Simulation and Modeling—F.Y. Hunt, M.A. Galler, and J.W. Martin

JCT, Vol. 70, No. 880, 45 (May 1998)

The role of pigment particle size, pigment volume concentration, and dispersion in gloss loss of paint films on weathered surfaces is unclear. Because reproducible and cost effective data are difficult to obtain, an approach based on computer simulation and modeling is a promising supplementary tool. We describe the simulation of a painted surface consisting of pigment particles of known size, pigment volume concentration and dispersion, situated in a binder that erodes over time due to exposure to ultraviolet radiation. Pigment particle size, geometry, pigment volume concentration, and pigment particle dispersion are parameters of the model. Our purpose is to illustrate how simulation can be used to aid the development of formulation strategies for the design of coatings with desirable gloss characteristics.

A New Approach in the Development and Testing of Antifouling Paints Without Organotin Derivatives—K. Vallee-Rehel et al.

JCT, Vol. 70, No. 880, 55 (May 1998)

Environmental concerns have led to a progressive withdrawal of antifouling paints containing organotin derivatives. Resanbio[®]. A cooperative research program, plans to develop new antifouling paints that are more compatible with living species. In the first stage, we studied specific acrylic polymers with a variable hydrophilic/hydrophobic balance and, in some cases, pendant hydrolyzable functions. To evaluate the ability of these materials for hydrolysis, biocides release, and erosion, test panels with formulated films were prepared and immersed in sea water. An analytical protocol was established to characterize the polymeric material, to reveal chemical reactions that occur during erosion and antifouling action, and to understand the influence of the resin chemical structure on the paint's antifouling efficiency. The degradation of these binders was revealed by the appearance of a product resulting from the hydrolysis. This product was identified and quantified by GC-MS. The release of cuprous oxide as model molecule, due to its water solubility and biocide activity, was quantified by inductively coupled plasma. The different processes used are explained and illustrated by an example of an efficient, erodable, antifouling paint following 22 months of immersion.

Photodegradation of Water-Based Acrylic Coatings Containing Silica—A.M. Morrow, N.S. Allen, and M. Edge

JCT, Vol. 70, No. 880, 65 (May 1998)


The durability of acrylic copolymer systems containing silica as a matting agent are investigated, with particular emphasis on the photodegradation process. The effects of the photodegradation process on the films are monitored chemically via reflectance FTIR spectroscopy and UV spectrophotometry and monitored physically via gloss levels, optical properties, film thickness, and film smoothness measurements of the cured film. The findings of this study show that as a result of photo-oxidation high levels of hydroperoxides are observed. In addition the FTIR results, which are discussed from a mechanistic point of view, indicate that functional group formations and crosslinking reactions which occur as a consequence of photodegradation, play a primary role. Therefore, this study suggests that silica can reduce the durability of acrylic based formulations and that the extent of this photodegradation appears to be dependent on silica type.

Novel Ambient Temperature Curable Two-Component Waterborne Silicone-Acrylic Coatings—N. Harui and T. Agawa

JCT, Vol. 70, No. 880, 73 (May 1998)

Waterborne coatings are composed of resins containing hydrophilic functional groups. These groups usually remain in the coating film and can adversely affect film properties such as weatherability and resistance to water and alkali. We have developed a novel ambient temperature curable waterborne two-component system, in which the hydrophilic functional groups are consumed by the crosslinking reaction. The new coating system consists of a waterborne acrylic resin containing both tert-amino and carboxylic acid groups and a hardener containing both epoxy and alkoxyethyl groups. The waterborne silicone acrylic coatings provide superior film properties even if the acrylic resin has relatively low functional group content.

In this paper we describe the crosslinking reaction mechanism and film properties using some acrylic resin types and paint formulations as examples.



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Relación Entre la Pérdida de Brillo y la Micro-Estructura de una Pintura Intemperizada. Modelo de Simulación Computadora—F.Y. Hunt, M.A. Galler, y J.W. Martin

JCT, Vol. 70, No. 880, 45 (May 1998)

El artículo describe el efecto que tiene el tamaño de partícula, la concentración del pigmento en volumen y el nivel de dispersión sobre la pérdida de brillo de una pintura cuya superficie fue intemperizada. Debido a que la reproducibilidad y el costo efectivo de los datos dificultan el obtenerlos, se presenta como una herramienta auxiliar un modelo de simulación como una base de desarrollo aproximada. Describimos mediante una simulación de una superficie de pintura donde se conoce el tamaño de partícula de pigmento, la concentración de pigmento en volumen y el grado de dispersión colocados en un vehículo el cual se erosiona con el tiempo debido a la exposición a rayos ultravioleta. El tamaño de las partículas de pigmento, el PVC y el grado de dispersión de las partículas son parámetros de este modelo. Nuestro propósito es ilustrar como la simulación puede ser un recurso para el desarrollo de formulaciones estratégicas donde se requiere el diseño de recubrimientos con características deseadas de retención de brillo.

Un Nuevo Avance en el Desarrollo y Evaluación de Pinturas Antihongos sin Derivados Orgánicos de Estaño—K. Valle-Rehel et al.

JCT, Vol. 70, No. 880, 55 (May 1998)

La preocupación permanente sobre la protección ambiental y la eliminación progresiva del plomo y de los derivados orgánicos de estaño de las pinturas antihongos, son el origen de un programa cooperativo de investigación Resabio® con el cual se planea el desarrollo de una nueva pintura antihongos que sea más amigable con las especies vivas. En la primera parte de este artículo se estudio un polímero acrílico específico donde se varia el balance hidrofílico/hidrofóbico con grupos funcionales hidrolizables reactivos. Para evaluar la capacidad de hidrolización de este material, la facilidad de migración del biocida y su habilidad para erosionarse. Paneles de prueba fueron preparadas con películas de pinturas con este material y se colocaron en inmersión en agua de mar. Se estableció un programa de análisis para caracterizar el material polimérico y para evidenciar la reacción química que ocurre durante la erosión y la acción antihongo, además de que se comprendió la influencia de la estructura química de la resina en la eficiencia de las pinturas antihongo. La degradación de estos vehículos se determino mediante la aparición de los productos resultantes de la hidrólisis. Estos productos fueron identificados y cuantificados mediante cromatografía de permeación de gel (GC-MS). Se tomo como modelo molecular, la liberación de oxido cuprose, debido a su solubilidad en agua y a la actividad biocida, esta liberación del agente antihongo se cuantifico mediante inductividad de acomplamiento de plasma. Diferentes procesos se utilizaron para explicar e ilustrar la eficiencia de una pintura erosionable antihongos después de 22 meses de inmersión.

Foto-Degradación de los Recubrimientos Acrílicos base Agua que Contienen Silica—M. Morros, N.S. Allen y M. Edge

JCT, Vol. 70, No. 880, 65 (May 1998)

El proceso de foto-degradación se ha investigado con énfasis particular en los sistemas de copolímeros acrílicos que contienen silica como agente matenante, ya que afectan su durabilidad. Los efectos químicos en la película foto-degradada fueron monitoreados mediante espectroscopia de reflectancia FTIR y con espectrofotometría U.V. y los efectos físicos se monitorearon mediante la evaluación de los niveles de brillo, espesor de película, tersura y curado de la película. Se concluyo de este estudio que como resultado de la foto-oxidación se presentan altos niveles de hidroperóxidos en la película. En suma los resultados del FTIR, en los cuales se discuten desde el punto de vista del mecanismo de reacción, indican que la formación de grupos funcionales así como las reacciones de reticulación ocurren como una consecuencia del proceso de foto-degradación y que juegan un papel primordial. Entonces, este estudio sugiere que la silica puede reducir la durabilidad de los recubrimientos formulados a base de resinas acrílicas y que la extensión de la aparición de esta foto-degradación va a depender del tipo de silica.

Original Recubrimiento de dos Componentes Base Agua Silicón-Acrílico que Cura a Temperatura Ambiente—N. Haruy y T. Agawa

JCT, Vol. 70, No. 880, 73 (May 1998)

Los recubrimientos base agua están compuestos por resinas que contienen grupos funcionales hidrofílicos. Estos grupos normalmente permanecen en la película del recubrimiento y afectan de forma adversa las propiedades de la película tales como la resistencia a la intemperie y la resistencia al agua y a los álcalis. Hemos desarrollado un sistema de dos componentes base agua que cura a temperatura ambiente en la cual los grupos funcionales hidrofílicos son consumidos mediante una reacción de reticulación. El nuevo sistema de recubrimiento consiste de una resina acrílica base agua que contiene tanto los grupos ter-amino y grupos ácido carboxílicos y un endurecedor con grupos epoxy y alquilosilanos. El recubrimiento obtenido acrílico-silicon presenta propiedades de película muy superiores, si la resina acrílica tiene relativamente un contenido bajo de grupos funcionales. Este artículo describe el mecanismo de reacción de la reacción de reticulación y las propiedades de película utilizando algunos tipos de resina acrílica y algunas formulaciones de pintura como ejemplo.

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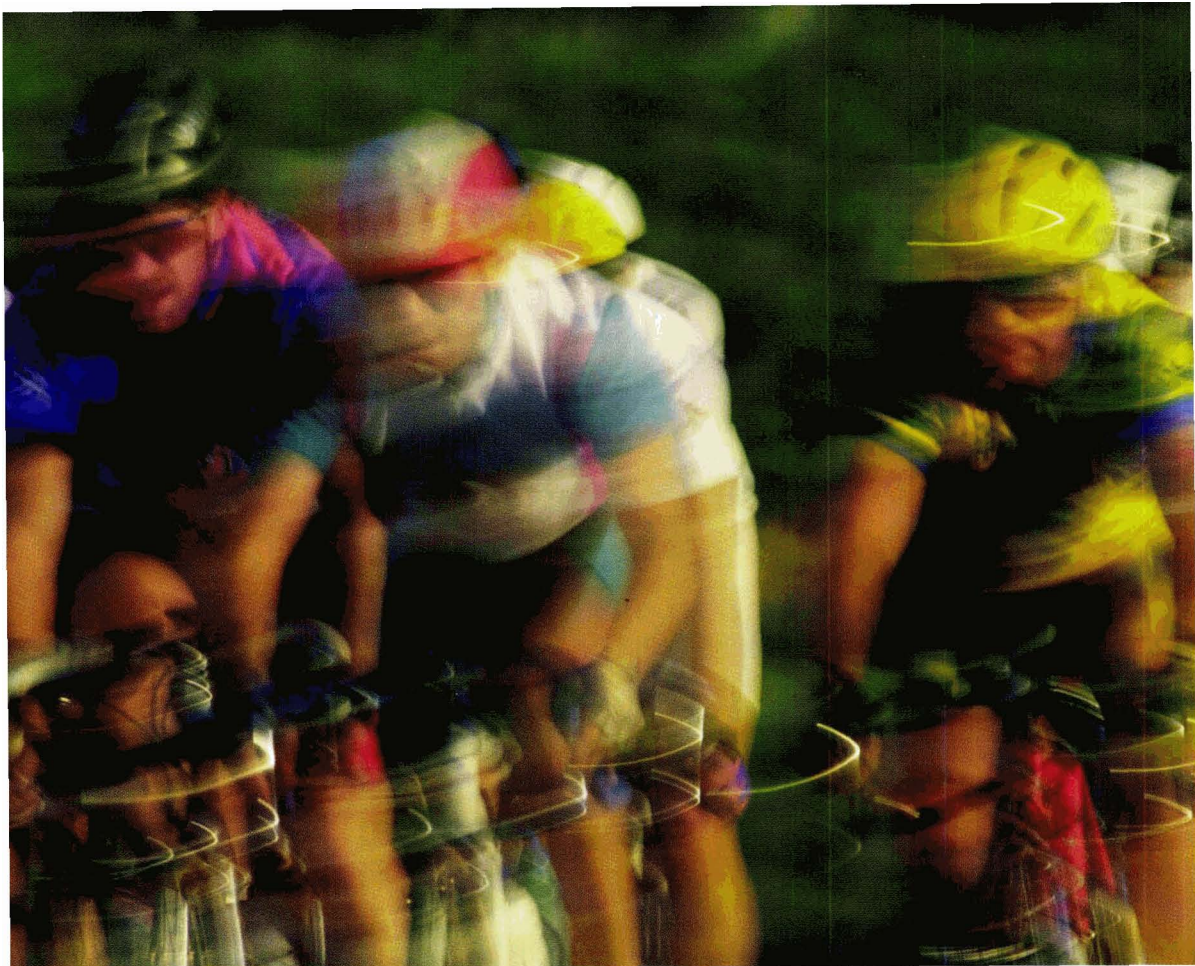
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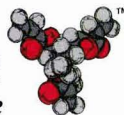
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Circle No. 158 on the Reader Service Card

Bayer Corp. Announces Plans to Reduce Waste and TRI Figures 33% by 2001

Bayer Corp., Pittsburgh, PA, recently revealed plans to reduce its rate of environmental waste generation by 33% by 2001. The company also set a 33% reduction goal with a similar time frame for emissions of compounds tracked by the U.S. Envi-

ronmental Protection Agency's Toxic Release Inventory (TRI).

According to Helge H. Wehmeier, President and CEO, of Bayer Corp., "Our goal is to continuously reduce all waste throughout the corporation, whether toxic or not. One way to achieve this

corporate objective is to continually improve our manufacturing processes and procedures." In addition, Mr. Wehmeier also said that from 1992-96, Bayer reduced its overall waste generation rate by 26%.

Some of Bayer's most recent environmental achievements include:

- The company's waste reduction efforts in 1997 resulted in a 16% decline in the rate of waste generation compared to 1996. From 1992 through 1996, Bayer reduced production waste from 60.5 pounds per thousand pounds of product to 45.0 pounds per thousand—a 26% reduction;

- Bayer expended \$147 million on its environmental capital improvements and operations in 1997. The company has committed a total of \$617 million to environmental operations in the past five years;

- When EPA asked U.S. manufacturers to voluntarily reduce emissions of priority TRI pollutants by 50% by 1995, Bayer achieved a 60% reduction. Two of the company's largest sites, Baytown, TX, and Elkhart, IN, reduced such emissions by more than 90%; and

- Bayer actively participates in the Responsible Care® initiative sponsored by the Chemical Manufacturer's Association and has implemented all of the program's six codes of management practice: community awareness and emergency response; pollution prevention; process safety; distribution; employee health and safety; and product stewardship.

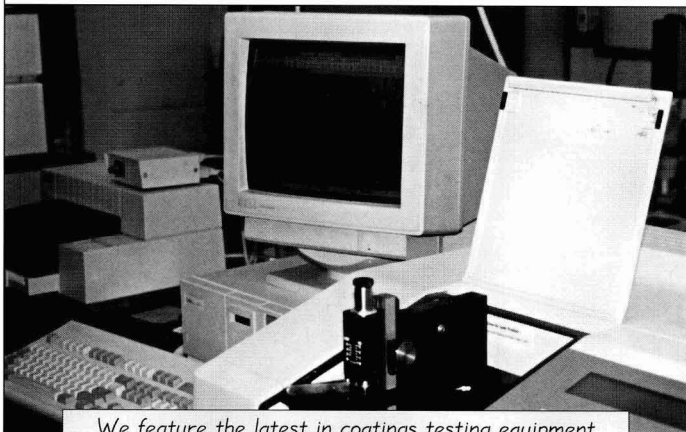
Mr. Wehmeier added that Bayer will continue to aggressively reduce its release of nitrates, a salt compound that the EPA recently added to its TRI.

Ah, Spring...

THE BIRDS, THE FLOWERS, SPRING RAIN SHOWERS...
THE PEELING PAINT, THE CHLORIDE DEPOSITS,
THE RUST, THE SPONTANEOUS FAILURES.

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Troy Acquires Allied Signal's Mergal Biocides Business

Troy Corp., Florham Park, NJ, and AlliedSignal Inc., Morris Township, NJ, have announced that Troy has acquired AlliedSignal's Riedel-de Haen Mergal® biocides business. Terms of the transaction were not disclosed.

Mergal products are used as technical and dry-film preservatives to protect consumer and industrial products against fungi, algae, and other microbial degradation.

Circle No. 175 on Reader Service Card

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With **SER-AD™ FA 379** you can now win this age-old battle.

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In an advanced rust-preventive chemical mechanism, molecules of SER-AD FA 379 are absorbed on the ferrous substrate — stopping corrosion before it starts through anodic passivation, a process that's been used for years to fight rust in marine environments.

But SER-AD FA 379 doesn't stop there. It also protects against in-can corrosion during storage and then functions as a corrosion inhibitor in the dry film. What's more, because it's free of water-soluble sodium salts, SER-AD FA 379 does not increase the water sensitivity in dry films.

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Prevents in-can corrosion	●	●
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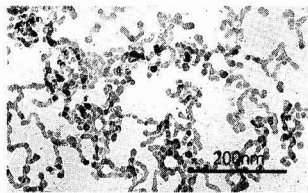
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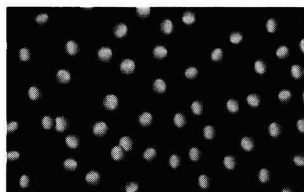
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Circle No. 169 on Reader Service Card

New Study Predicts Three Percent Increase In World Carbon Black Consumption by 2001

A new study from The Freedonia Group Inc., Cleveland, OH, "World Carbon Black" forecasts that world carbon black consumption will increase three percent per year to 7.8 million metric tons in the year 2001, tracking gains in rubber demand over the same period. Use as a reinforcement in vulcanized rubber goods will account for 94% of total demand, including 68% for tires. However, special blacks will offer the market's most rapid gains due to increasing use in plastics, printing inks, and paints. While special blacks are a relatively minor segment as measured in tonnage, they command considerably higher per kilogram values than commodity furnace blacks.

According to the study, Asia/Pacific will post the strongest gains, due mainly to the ongoing development of China's tire industry. However, increases will be below prior projections due to the financial crisis that swept the Pacific Rim in late 1997. The North American market will continue to expand, even given its strong 1996 base, while Western Europe and Japan, both recovering from weak showings in the first half of the 1990s, will see modest gains. Latin America offers solid opportunities, particularly in Brazil, while in Eastern Europe, strongest prospects lie with the Czech Republic, Hungary, and Poland.

Kerr-McGee Chemical Corp. Sells Two Businesses

Kerr-McGee Chemical LLC, Oklahoma City, OK, has signed an agreement in principle with Castle Harlan, Inc., a New York-based private merchant bank, to sell its forest products operations. The agreement in principle covers marketing and operations at the company's six cross-treating plants. The company's forest products division currently operates plants at Columbus, MS; The Dalles, OR; Indianapolis, IN; Madison, IL; Springfield, MO; and Texarkana, TX.

In addition, Kerr-McGee closed the sales of its ammonium perchlorate business to AMPAC, Inc., a subsidiary of American Pacific Corp., Las Vegas, NV.

Both transactions are part of the company's strategy of focusing on its worldwide oil and gas exploration and production operations and titanium dioxide pigments business. With the sale of the ammonium perchlorate business, Kerr-McGee completed its exit from the commercial manufacture of this oxidizer for the solid fuels used in space shuttle launches and military missiles.

Tire markets for carbon black are forecast to grow three percent per year to 5.3 million metric tons in the year 2001, benefiting from rising tire production levels as well as the continuing popularity of performance tires, particularly in developed regions. Carbon black used in non-tire rubber products will increase three percent per year to two million metric tons in the year 2001, with demand remaining linked mainly to industrial rubber products such as hoses, belts, and mechanical goods. Plastics and printing inks will continue to dominate demand for special blacks, accounting for nearly 75% in the year 2001. In developed regions, paints and coatings are also a major use, but the lack of large paint and coating markets in many developing countries mitigates the importance of this end use on a world level.

"World Carbon Black" is available for \$3,900 from The Freedonia Group, Inc., 3570 Warrensville Center Rd., Ste. 201, Cleveland, OH 44122; (216) 921-6800.

Weskem Hall Signs Letter of Intent to Sell Energy Interests

Weskem Hall, St. Louis, MO, has signed a letter of intent to sell its energy interests, the Weskem division, to Van Waters and Rogers Inc., Kirkland, WA.

The Hall division of Weskem Hall will remain a wholly owned subsidiary of C&G Holdings, Inc. With branches in Kansas City, MO, Memphis, TN, and Houston, TX, the Hall division, will continue to service the coatings, inks, lubricant, rubber, and plastic compounding markets as it has since 1963.

This transaction includes only the nine Weskem division locations throughout the energy belt which distributes chemicals to the oil and gas industries.

Price Adjustments

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PRODUCT: All surfactants and speciality ingredients

INCREASE: 5%
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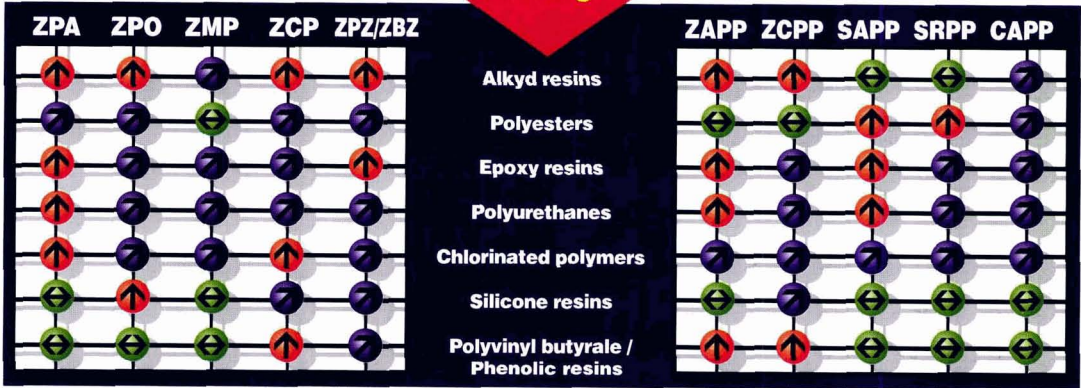
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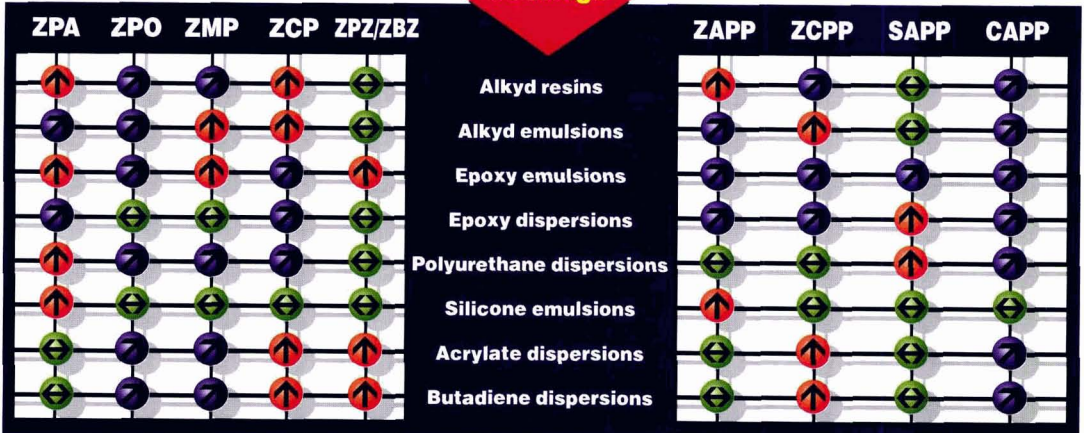
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| 10. HEUCOPHOS SRPP | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. HEUCOPHOS CAPP | <input type="checkbox"/> | <input type="checkbox"/> |
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FSCT Annual Meeting

Technical Conference

October 11-14, 1998

Topics Include

Corrosion
Powder
Radiation Cure



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Technology Conference Program



Sponsored by the Federation of Societies for Coatings Technology, the 1998 Technology Conference will feature three two-day courses, 11 one-day programs and two Executive Forums. The conference will begin on Sunday, October 11, 1998 and conclude with an Executive Forum on Wednesday, October 14, 1998. There is an additional fee to attend the conference courses. The preliminary schedule for the Technology Conference is as follows.

Sunday - Monday, October 11-12, 1998 (Two-Day Course)

Back to Basics: Resins, Pigments, Solvents and Additives

Course description

For chemists, lab technicians, sales, marketing, and field support personnel new to the industry or with minimal experience. Participants will gain a better understanding of the four main components that make up the basic composition of coatings (resins, pigments, solvents, and additives), the role each plays in the development of coatings, the effect of various application methods on coatings performance and will be given tips on troubleshooting techniques to effectively formulate coatings.

Instructor

Taki Anagnostou, Consultant

Attendance limit

125

ICE '98 Technology Conference

October 11 - 14

FSCT Annual Meeting

October 14 - 16

ICE '98 Expo

October 14 - 16

Sunday, October 11, 1998 (One-Day Courses)

Spray Applications Workshop

Course description

Considered a "Learning Exchange Seminar," this workshop 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.

Attendees will learn

- Various types of spray equipment (adjust, tip, size, fanning technique)
- How to choose equipment wisely
- Problem solving techniques
- Proper care and maintenance of spray equipment
- Electrostatic application of liquid and powder coatings
- Application of coatings by air atomization, airless and air-assisted airless
- Various operator techniques
- High volume low pressure (HVLP)

Instructor

Jerry Hund, Binks-Sames

Attendance limit

35

Effective Negotiating Skills

Course description

This custom-designed course provides negotiating examples and simulations for the coatings industry, addressing the needs and concerns of the participants. This course will teach the attendees how to achieve the best results potentially available in each negotiation. The

Technology Conference Program

course is designed for technical staff and sales personnel, along with anyone else in the organization responsible for negotiating as part of the job responsibility.

Attendees will learn

- When negotiations really start
- How to understand the dynamics of the negotiation process
- Fourteen systematic planning steps
- Specific strategies and tactics with counter measures
- Approaches for each negotiation's competitive and cooperative aspects
- Effective communication techniques
- How to create new solutions
- Dispute resolution methodologies, including arbitration and mediation, for formal and informal use

Instructor

Mark K. Schoenfield, Schoenberg, Fisher, Newman & Rosenberg

Attendance limit

35

Chemistry and Formulation of Powder Coatings

Course description

Designed to provide formulators, R&D chemists, technical directors, and company decision makers with information on the basic processes of formulating powder coating, this course will be beneficial to both newcomers to the powder coatings industry as well as give information to those companies that are considering adding powder coatings as a product line.

Attendees will learn

- What is powder coating
- The basic chemistry principles as related to the formulation of powder coatings
- What processes are utilized in the preparation of powder coatings
- Information on the manufacture of powder coatings
- Recent advances in powder coating technology
- Current powder coating application methods

Instructors

Kevin Biller, Biller Technical Resources and Alan J. Pekarik, SC Johnson

Finance for the Nonfinancial Manager

Course description

This course is designed to provide non-financial staff, such as technical directors, lab managers, field service personnel and others, with a fuller understanding of the financial side of the business operation. Attendees will gain a better grasp of the information that is contained in the data generated by financial departments and how this information can be used in the day-to-day operations of the organization.

Attendees will learn

- Economic value added (EVA) information generated by the financial staff
- How to understand the entire budgetary process
- How to read and understand the financial information that companies distribute, such as balance sheets
- The meaning of the financial acronyms used by the accounting and financial staff
- The value of business plans to the operation

Attendance limit

50

Instructor

Jack Park, Consultant



Conference

Hours

Sunday, October 11
8:00 am – 5:00 pm

Monday, October 12
8:00 am – 5:00 pm

Tuesday, October 13
8:00 am – 5:00 pm

Wednesday, October 14
8:00 am – 5:00 pm

Technology Conference Program



Monday - Tuesday, October 12-13, 1998

(Two-Day Courses)

Introduction to Radiation Curing

Course description

Radiation curable coatings are fast becoming an efficient method to meet the regulatory challenges facing the industry. This course is designed for formulating chemists, R&D chemists, technical directors and company decision makers in the adhesives, inks, plastics and coatings industries, and will provide details on the basics of radiation cure as a low VOC, low energy cure technology.

Attendees will learn

An introduction to energy cured systems, including free radical, cationic and electron beam
Up-to-date information on photoinitiators
Equipment used in radiation curing
Toxicology, safety and handling issues
Energy cured formulations

Instructors (partial list)

Latoska Price, Akzo Nobel
Chai-hu Chang, Ciba
Richard Stowe, Fusion UV Systems
Ron Golden, UCB Chemical Corp.

Roy Modjowski, Akzo Nobel
John Braddock, Union Carbide
Paul Gupta, Flint Ink Corp.
James Fleischer, Red Spot Paint

ICE '98 Technology Conference

October 11 - 14

FSCT Annual Meeting

October 14 - 16

ICE '98 Expo

October 14 - 16

Crosslinking for the Coatings Chemist

This course has been developed by the FSCT Professional Development Committee.

Course description

This course is designed for formulators, polymer chemists, and those involved in these end use applications: automotive, architectural and general industry. The purpose of the course is to provide information on the chemistry of crosslinking, including topics such as descriptions of the various chemistries, fundamentals of inter-intra molecular crosslinking, temperature requirements, and measurement criteria. All attendees are required to have a background in Chemistry.

Attendees will learn

Theory of crosslinking; physical chemistry of crosslinking; mechanical properties of crosslinking; film formation of waterborne coatings; IPNs; UV; solventborne polyurethanes; waterborne polyurethanes; melamine and other amino acids; epoxy resins; alkyds and air drying resins; aziridines; silanes; aceto acetate; and powder coatings.

Instructors (partial list)

Peter Pappas, Polychrome Corp.
John Gillham, Consultant
Loren Hill, Solutia
Mitchell Winnik, University of Toronto
Paul Hung, Rhodia Inc.
Douglas Wicks, Bayer

Frederick Walker, Air Products
Colin Brogan, Cytec
Dennis Olszanski, OMG Americas
Howard Bender, BFGoodrich
Gerald Witucki, Dow Corning Corp.

Monday, October 12, 1998

(One-Day Courses)

Fundamental Ink Technology

Course description

Designed for technicians, sales personnel, quality control/assurance staff, and technical service personnel in the graphic arts or related fields, attendees will become more familiar with the formulation, manufacturing, processing and problem solving issues related to the development and manufacture of water-based inks. Course participants will receive an overview of the types of inks, the methods of formulation, and methods used in the

Technology Conference Program

manufacturing and testing of liquid inks. The course will conclude with a problem solving session to allow the attendees time to have their questions debated and answered by the instructor.

Attendees will learn

About the ink market and how water-based inks are used
The proper problem solving techniques utilized in the development of ink
Methods related to the manufacturing and testing of inks, including print quality evaluation
The materials (resins, pigments, additives and solvents) used in the formulation of inks
Various printing processes, such as flexographic and gravure
The types of inks being developed and their uses

Instructors (partial list)

David H. Fishman, Fishman, Inc.

Attendance limit

125

Corrosion Control Coatings for Steel Bridges

Course description

This course is designed for paint suppliers, raw material suppliers for industrial coatings, researchers, DOT engineers, coatings specifiers, R&D chemists, civil engineers and structure owners. It will provide current information regarding the performance, testing, and application of various innovative coating materials for steel structure coating protection. The course will present the attendees with mature laboratory and field experience and technical data regarding the performance of compliant coatings. The seminar will also provide attendees with guidance as to the future technical direction in this field using the work of several regional state agencies that have been in the forefront in the efforts to convert to waterborne and extreme low VOC coating materials.

Attendees will learn

The current state of the industry regarding materials usage
The current direction of the steel structures industry
The state of compliance with environmental regulations
Unique insights into the durable and compliant coating technologies
How various coatings perform under laboratory and field testing

Instructor

Bob Kogler, Federal Highway Administration

Management Skills for New Supervisors

Course description

Designed for newly appointed managers, supervisors, team leaders, and group supervisors, this course will teach attendees how to communicate their strategy in a manner that is most likely to create clear understanding and buy-in. The course is taught with interactive dialogue, case studies and the use of straightforward models.

Attendees will learn

How to build and develop critical skills necessary to ensure success in this key juncture
How to link employee actions to product delivery, customer satisfaction and organizational viability
Motivational techniques for employees
The skills necessary to succeed in management, and those which are not mandatory

Attendance limit

50

Effective Technical & Scientific Writing Workshop

Course description

This course is intended 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



Conference

Hours

Sunday, October 11
8:00 am – 5:00 pm

Monday, October 12
8:00 am – 5:00 pm

Tuesday, October 13
8:00 am – 5:00 pm

Wednesday, October 14
8:00 am – 5:00 pm

Technology Conference Program



practical application and allows time for individual instructor attention. Participants are invited to submit writing samples in advance for confidential review by the instructor.

Attendees will learn

Skills and techniques to improve technical communication
How to improve effectiveness in communicating technology
Data collection and tabulation (maximize impact of data)
To make technical issues understandable
How to translate technical terms to easily understood everyday language
Writing skills/structure, format
"Rethink how you write"

Instructor

Sal Iacone, Consultant

Attendance limit

35

Tuesday, October 13, 1998 (One-Day Courses)

Surfactant Chemistry and Application

Course description

For R&D personnel, technicians, formulating chemists and application chemists, along with technical service personnel in the coatings and inks industries, this course will provide attendees with a better understanding of the various aspects of surfactant chemistry and its effect on the development of coatings and inks. Attendees will also develop an open thinking approach to surfactants and problem solving. This course content will include case studies. Attendees are encouraged to submit questions in advance.

Topics to be covered

Overview of surfactant types and chemistries
General surfactant properties in solution
Wetting and dispersion phenomena on surfaces
Application case study: surface tension coatings defects and substrate wetting
Application case study: wetting and dispersing
Application case study: solving foam problems in coatings
Panel discussion: problem solving with surfactants and defoamers

Instructors (partial list)

Bob Stevens, Air Products	Joel Schwartz, Air Products
Rene Levousier, Byk Chemie	Ed Orr, Byk Chemie
Steve Snow, Dow Corning	Andy Romano, Ashland

Attendance limit

100

Marine Coatings

This course has been developed by the FSCT Corrosion Committee.

Course description

This course is designed to review relevant aspects of marine coatings such as specifications, coatings types, surface preparation, failure mechanisms, testing and performance, and coatings inspection. It is ideal for formulators, R&D chemists, technical service personnel, and technical management. Attendees will gain a basic understanding of marine coatings and the criteria needed to select the appropriate coating for a marine environment.

Attendees will learn

The variety of coatings specifications used in the marine environment
The appropriate surface preparation for a variety of applications
How to recognize the common areas of failure
Proper testing techniques to replicate the performance characteristics
The latest inspection techniques

ICE '98 Technology Conference

October 11 – 14

FSCT Annual Meeting

October 14 – 16

ICE '98 Expo

October 14 – 16

Technology Conference Program

Winning Technical Presentations

Course description

For laboratory and R&D personnel at all levels, in addition to marketing and sales staff and anyone else responsible for delivering technical presentations, this program offers a combination of lecture, interaction, and small group projects.

Attendees will learn

- How to effectively develop visuals for technical presentations
- Proper speaking techniques and how to effectively communicate to all audiences
- How to organize data and tips on transferring written information to speaking terms
- How to handle question and answer sessions
- Presentation style and format

Instructor

Carter Johnson, Buying Time Seminars

Attendance limit

35

Executive Forum I: New Product Development (Stage Gate)

Course description

A one-day interactive workshop, this course introduces participants to the "why's" and "how's" of enterprise-wide new product development (NPD), fuzzy front end processes, concept generation, portfolio management, supporting systems and tools and fast development. The course is geared toward company executives and decision makers with key responsibilities for improving their organization's NPD output.

Attendees will learn

- The major problems and challenges with most new product development processes
- Why speed to market is non-sufficient
- How to develop NPD strategy that delivers results; assess the risks of NPD projects and portfolios; and ways to align fuzzy front end processes with NPD process
- Methods to turn NPD ideas into organizational actions
- How to effectively use the tools and techniques that support the NPD process

Instructors

Paul O'Connor, Adept Group, Ltd. and Christopher Miller, Innovation Focus

Attendance limit

100

Wednesday, October 14, 1998 (One-Day Course)

Executive Forum II: Global Commercialization Strategies

Course description

The course is designed for all market development personnel, technical directors, and other members of the corporate management team of organizations currently or contemplating doing business outside of their immediate geographic region. It is developed to give attendees a better understanding of the many issues related to international business and provide the participants with increased knowledge of the international marketplace.

Attendees will learn

- How to better commercialize internationally
- What will have to be considered, the key drivers, in most popular international markets
- Different market testing techniques to measure product acceptance
- Trademarking issues in foreign markets
- The differences in patent law from region to region

Instructor

Alex Ramig, AR Associates

Attendance limit

75



Conference

Hours

Sunday, October 11
8:00 am – 5:00 pm

Monday, October 12
8:00 am – 5:00 pm

Tuesday, October 13
8:00 am – 5:00 pm

Wednesday, October 14
8:00 am – 5:00 pm

Annual Meeting Technical Program



Participants of ICE '98 will have a chance to attend the FSCT Annual Meeting Technical Program sessions as part of their registration. The 1998 Annual Meeting Technical Program will feature 18 separate sessions over three days. There is no additional charge for ICE '98 attendees to participate in the Technical Program activities. The tentative program is as follows.

Mattiello Memorial Lecture

The premier technical lecture of the coatings industry, the 1998 Mattiello Lecture will be held on Wednesday, October 14. The Mattiello Lecturer is an individual who has made outstanding contributions to science, technology, and engineering as related to the coatings industry. The selected lecturer embodies the standards of technical accomplishment, service to the coatings industry and leadership established by Joseph J. Mattiello, who did much to expand the application of science in the decorative and protective coatings field. The 1998 lecturer is Dr. Clifford Schoff, of PPG Industries, Allison Park, PA.

Technical Focus Lecture

Now an established part of the Annual Meeting Technical Program landscape, the Technical Focus Lecture is delivered by an individual selected for on-going work in critical technical areas of the coatings industry. The award recipient is selected by the Chairs of several FSCT committees.

Advanced Topics in Coatings Technology

The FSCT Professional Development Committee has developed a half-day symposium on the topic of "Advanced Mechanisms in Thermoset Waterborne Coatings." The session will feature technical presentations on the latest advances in this field.

Roon Award Competition Papers

This represents the best technical work directly related to the protective coatings industry. The Roon Award Competition Papers describe original work of highly scientific caliber, not previously presented or published. Awards for these papers are determined on the basis of originality, scientific importance, practical value and the quality of composition.

Understanding the Internet

This session will provide attendees with an opportunity to learn exactly how the Internet can be used as a resource in a variety of ways. Participants will learn the proper techniques to conduct technical searches, how to locate educational venues and resources, the benefits of using the Internet as a new product research and development tool, how to "avoid the noise" when conducting searches and how to gain additional technical information quickly to assist with many on-going projects.

APJ/Voss Award Competition Papers

Technical papers presented in this session are developed by the Technical Committees of the FSCT Constituent Societies. The presentations involve research, development, manufacture or application of the industry's products or raw materials, and the papers compete for the APJ/Voss Award and the Society Speakers Award.

Suppliers Spotlight

This session will give attendees an opportunity to learn about the latest product advances being created by the raw materials and equipment suppliers to the coatings industry. Presentations will include the science and technology behind the new developments. Attendees will have the opportunity to question the speaker at the conclusion of each presentation.

Coatings Specification Roundtable

Attendees can meet with the experts to discuss the why's and how's of various coatings specifications. Anyone involved in the development of coatings specifications, or responsible for adhering to specs, can't afford to miss this session.

Poster Session Papers

The popular Poster Session, a fixture at the Annual Meeting for the last six years, takes on a new look. The information contained on the posters will now be orally presented to the attendees, in addition to being displayed.

ICE '98 Technology Conference

October 11 – 14

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October 14 – 16

ICE '98 Expo

October 14 – 16

Annual Meeting Technical Program

Women in Coatings

Successfully presented during the 1997 Annual Meeting Technical Program, the Women in Coatings session returns in New Orleans. The panel discussion will feature female leaders of the coatings industry addressing a timely topic—the role of women in the paint and coatings industry, both now and in the future.

International Papers

The papers presented during this session represent the premier work taking place around the globe in the area of paints and coatings. This popular session reflects the growing international presence among the attendees at ICE. Most papers disseminate information on technologies which affect the global marketplace or detail some of the latest technical advances outside of North America.

Outstanding Corrosion Paper Competition Submissions

These papers are all entries in the initial Outstanding Corrosion Paper Award Competition. The award is sponsored by the FSCT Corrosion Committee.

General Coatings Technology Papers

This session will include those works deemed most timely from a technical nature of all papers submitted for consideration to the Annual Meeting Program Committee. These papers usually include technical information which can be used immediately in the work place.



ICE '98 Tentative Schedule of Events

Saturday, October 10

Registration Services	1:00 pm to 5:00 pm	Convention Center
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Sunday, October 11

Registration Services	7:30 am to 5:00 pm	Convention Center
Technology Conference	8:00 am to 5:00 pm	Convention Center

Monday, October 12

Registration Services	7:30 am to 5:00 pm	Convention Center
Technology Conference	8:00 am to 5:00 pm	Convention Center

Tuesday, October 13

Registration Services	7:30 am to 5:00 pm	Convention Center
Technology Conference	8:00 am to 5:00 pm	Convention Center
Mardi Gras Networking Party	5:30 pm to 7:00 pm	Marriott Hotel

Wednesday, October 14

Registration Services	7:30 am to 5:00 pm	Convention Center
Technology Conference	8:00 am to 5:00 pm	Convention Center
Mattiello Lecture	8:30 am to 10:00 am	Convention Center
Expo Hours	10:00 am to 5:00 pm	Convention Center
Annual Meeting Program	1:00 pm to 5:00 pm	Convention Center
Social Guests Optional Tours	1:00 pm to 4:00 pm	Depart from Convention Center

Thursday, October 15

Registration Services	8:00 am to 5:00 pm	Convention Center
Expo Hours	9:00 am to 5:00 pm	Convention Center
Annual Meeting Program	9:00 am to 5:00 pm	Convention Center
Social Guests Optional Tours	Times vary	Depart from Convention Center

Friday, October 16

Registration Services	8:00 am to 12:00 noon	Convention Center
Expo Hours	9:00 am to 12:00 noon	Convention Center
Annual Meeting Program	9:00 am to 12:00 noon	Convention Center

FSCT Annual Meeting Technical Program Hours

Wednesday, October 14
Mattiello Lecture
8:30 am – 10:00 am

Wednesday afternoon
1:00 am – 5:00 pm

Thursday, October 15
9:00 am – 5:00 pm

Friday, October 16
9:00 am – 12 noon

General Information



Network at "Mardi Gras in October"

On Tuesday, October 13, FSCT and its co-sponsors will hold a Mardi Gras networking party at the Marriott Hotel from 5:30 pm to 7:00 pm. Exhibitors and attendees welcome!



Social Guest Program

This year's Social Guest registration provides admittance to the FSCT Opening Gala "Mardi Gras in October" on Tuesday, October 13 as well as three days' admittance to the Expo. A hospitality room for Social Guests will be located in the Convention Center.

Social Guest registration is offered only to the spouse or guest of the industry attendees. To register, complete the Social Guest portion of the registration form provided in this brochure. Advance Registration fee is \$25. On-Site fee in New Orleans is \$25.

Optional ICE Tours

A variety of guided tours will be available to Social Guests on Wednesday, October 14 and Thursday, October 15. To register for a tour, select the tour(s) desired on the registration form and pay the tour fee. A confirmation of tour(s) selected will be mailed to each participant. Tour cancellations received after September 18 will be assessed a \$25 processing fee. FSCT reserves the right to cancel any tour if less than 30 participants have signed up by September 11. A full refund will be provided if a tour is cancelled by FSCT.

Due to limited attendance, advance registration is strongly recommended.

ICE '98 Technology Conference

October 11 - 14

FSCT Annual Meeting

October 14 - 16

ICE '98 Expo

October 14 - 16

ICE Tours Schedule

All tours depart from the Convention Center. At the conclusion of each tour there will be a stop at the Marriott Hotel before the coach returns to the Convention Center.

Wednesday, October 14	1:00 pm to 4:00 pm	Jazz Tour	\$45
	1:00 pm to 4:00 pm	French Quarter Walking Tour	\$30
Thursday, October 15	9:00 am to 4:00 pm	Covington Charm	\$70
	9:00 am to 2:00 pm	Drestrehan & San Francisco Plantations Tour	\$45
	1:00 pm to 4:00 pm	Garden District Tour	\$30

Tours are available by pre-registration only. An ICE tour desk will be set up at ICE Registration in the Convention Center so that registered participants may obtain their tour tickets. The tickets are required for admittance to each tour.

A description of each tour offered follows.

Wednesday, October 14 (two tours offered)

All That Jazz Tour ----- 1:00 pm to 4:00 pm
Board motorcoaches from the Convention Center for a historical look at New Orleans, known throughout the world as the birthplace of Jazz. On the tour, pass the homes of some of the Jazz greats, visit the Old U.S. Mint's Jazz Collections, and pass the last remains of Storyville, where some of the great Jazz "professors" performed. **Fee \$45**

French Quarter Walking Tour ----- 1:00 pm to 4:00 pm
Motorcoaches will depart from the Convention Center for the French Quarter where famous landmarks of the area will be highlighted. Included in the walking tour is a visit to the Hermann-Grima House, circa. 1831. **Fee \$30**

Thursday, October 15 (three tours offered)

Covington Charm ----- 9:00 am to 4:00 pm
Motorcoaches departing from the Convention Center will take participants on an escape from the city, across Lake Pontchartrain, to the quaint old-world town of Covington. Before arriving in Covington, participants will visit Fancy Faces, home to the famous ceramic Mardi Gras mask. There a presentation of processes involved to make the masks will be provided. After the tour there will be time to make a mask.

Then it's off to a centuries old Acadian cottage for tea at the Jefferson House Tea Room. Following tea, guests will enjoy a stroll down Lee Lane where converted 19th century Acadian and Victorian style shops offer a shopper's paradise.

Box lunch provided.

Fee \$70

General Information

Drestrehan and San Francisco Plantations tour 9:00 am to 2:00 pm

Motorcoaches departing from the Convention Center will transport participants to two plantations. Drestrehan was built in 1787 and is the oldest documented plantation house left intact in the lower Mississippi valley.

Originally named San Frusquin (one's all) because of the extensive amount of monies spent on the mansion, San Francisco Plantation is an example of mid-19th century architecture.

Box lunch provided.

Fee \$45

Garden District Tour 1:00 pm to 4:00 pm

Motorcoaches will depart from the Convention Center for the Garden District—an area of the city known during the 19th century as the American section since English rather than French was its language. View elegant homes built prior to the Civil War and visit two private homes.

Fee \$30

Shuttle Service

Shuttle service will be provided between the participating hotels and the Morial Convention Center.

ICE Expo Shuttle Service

Tuesday, October 13 7:30 am to 6:00 pm

Wednesday, October 14 7:30 am to 6:00 pm

Thursday, October 15 7:30 am to 6:00 pm

Friday, October 16 7:30 am to 3:00 pm

Pick-up locations and up-to-date schedule information will be posted at the Morial Convention Center and in the lobby of each participating hotel.

Travel Notes

Airport and Ground Transportation

New Orleans International Airport serves the Crescent-City area. Airport Shuttle provides scheduled service from New Orleans airport to the downtown hotels every 15 minutes from 7:00 am to 11:00 pm. One-way runs \$10 and round-trip is \$20. The trip takes approximately 30 minutes. Taxi fares from New Orleans airport are calculated as follows: \$21 flat fare for one to two people, or \$8 per person for three to four people.

Weather

Temperatures average 72°F (22°C) in New Orleans during mid October. In the evenings expect the average temperature to be 53°F (12°C).

Dress

Business attire is appropriate for all events except for ICE Tours where casual/comfortable attire is recommended.

ICE '98 Airline Discounts — 3 Ways to Save

The official carriers for ICE '98 are Delta Airlines and US Airways. To receive the special convention rates*, you may wish to arrange your travel through the FSCT Travel Desk, through CMS, OR through the airlines meeting networks.

Book your travel when you register for ICE '98 through CMS Travel Service, or you can book through the FSCT Travel Desk call 1-800-448-FSCT and mention ICE '98.

Should you or your travel professional desire to make travel arrangements through the airlines directly, the phone numbers are listed below. Please be sure to mention the file numbers for additional savings!

Delta 1-800-241-6760

Mention File No. 111839A and meeting identifier code DMN111839A

US Airways 1-800-428-4322

Gold File No. 47140509

*Certain restrictions apply.

Book 60 days out and save!

If you book your airfare at least 60 days prior to the convention you will receive additional savings.

Visitor information on New Orleans is available on the world wide web at
www.neworleanscvb.com
www.whereneworleans.com



ICE '98 Expo Hours

Wednesday, October 14
10:00 am – 5:00 pm

Thursday, October 15
9:00 am – 5:00 pm

Friday, October 16
9:00 am – 12 noon

Guest Accommodations



CALL TODAY!! MAKE YOUR RESERVATION FOR ICE '98

800-424-5250 (U.S.)
847-940-2153
(international)

Prior to calling, please have the following information available:

- 1 Name of meeting attending (ICE '98)
- 2 Your four hotel choices (see hotel listings)
- 3 Number of rooms required
- 4 Arrival/Departure dates
- 5 Type of room(s) needed: (single, double, etc.)
- 6 Special requirements due to a disability
- 7 Number of persons in party
- 8 Credit card name, number, and expiration date
- 9 Names of those who will occupy the room
- 10 Your mailing address
- 11 Your phone, fax, and e-mail numbers.

The ICE '98 phone lines are open weekdays between 8:00 am to 5:00 pm central time.

Fax Your Hotel Reservation Form

800-521-6017 (U.S.)
847-940-2386
(international)

Fax lines are open 24 hours.

There are 12 hotels providing convention rates for ICE '98. Hotel reservations can be made by mailing or faxing the official hotel reservation form or by calling the ICE '98 Housing Bureau directly. Housing requests must be received by the Housing Bureau no later than **Friday, September 11, 1998**. Room rate availability cannot be guaranteed after this date.

Hotel reservations are placed on a first-come first-served basis. Please be sure to indicate four hotel choices. The Housing Bureau strives to place your first choice of accommodations. If that is not possible the next available choice will be used. You will receive a confirmation of your reservation from the Housing Bureau. If you provide a fax number or e-mail, your confirmation will be forwarded in the manner provided; otherwise it will be mailed. This is the only confirmation you will receive. You will NOT receive a confirmation from the hotel. Each hotel will honor the Housing Bureau's confirmation.

Rates

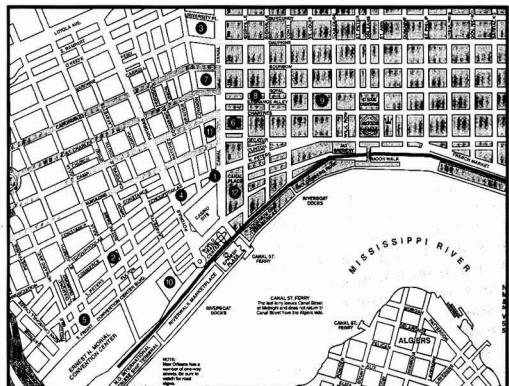
Hotel	Single	Double	Suites	
			1 Bedroom	2 Bedrooms
DoubleTree	\$154	\$154		
Embassy Suites	145	145		
Fairmont	165	165		
Holiday Inn Crowne Plaza	139	139		
Holiday Inn Select	139	139		
*Marriott (Headquarters)	170	190	\$650-850	\$820-1,020
Marriott - Concierge Level	203	203	\$600	\$803
Meridien	162	162	\$600	
Meridien Deluxe	182	182		
Monteleone	151	151		
Omni Royal Orleans	167	167		
*Riverside Hilton & Towers	169	189		
Hilton Executive	189	209		
Hilton Towers	219	239		
Sheraton	175	195	\$325 - 775	\$515-995
Sheraton Club Level	195	215		
Westin Canal Place	169	169		

*Exhibitors will be limited to a block of 10 rooms at the New Orleans Marriott and the Riverside Hilton and Towers. A one-bedroom suite counts as two rooms. A two-bedroom suite counts as three rooms.

Key: Single = room with one occupant; Double = room with two occupants, one bed; Twin = room with two occupants, two beds; 1-bedroom suite = living room parlor and one connecting bedroom; 2-bedroom suite = living room parlor and two connecting bedrooms.

KEY to MAP

- 1) DoubleTree
- 2) Embassy Suites
- 3) Fairmont Hotel
- 4) Holiday Inn Crowne Plaza
- 5) Holiday Inn Select
- 6) Marriott
- 7) Meridien
- 8) Monteleone
- 9) Omni Royal Orleans
- 10) Riverside Hilton & Towers
- 11) Sheraton
- 12) Westin Canal Place



Do not send your reservation request to the FSCT headquarters office since this will only delay the processing of your request.

Changes

Before September 11, identify any changes to the Housing Bureau. After September 18, contact the hotel directly regarding changes.

Deposit Information

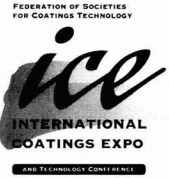
All hotels require a \$150 deposit to hold your reservation. The deposits will be processed through the ICE '98 Housing Bureau. Reservations without a deposit will not be placed. Deposits may be paid by check made payable to ICE '98 Housing Bureau or by credit card. Credit cards will be billed immediately.

Cancellation

If you cancel before September 11, a full refund of your deposit will be issued by the Housing Bureau. If you cancel after September 11, a \$15 processing fee will be assessed. If you do not cancel at least 72 hours prior to arrival your deposit becomes non-refundable.

1998 Housing Reservation Form

Reservations must be placed with the Housing Bureau. Hotels will not accept reservations directly. Reservations must be received by **September 11, 1998**.



1. To Make Reservations

CALL:

U.S. & Canada (toll-free)
800-424-5250
Domestic & Overseas
847-940-2153

Prior to calling, have the following available:

- ◆ Name of Convention ('ICE 98')
- ◆ Your 1st, 2nd, 3rd, & 4th choice of hotel
- ◆ Arrival/Departure dates
- ◆ Number of rooms required
- ◆ Type of room needed (single, double, etc.)
- ◆ Credit card #, expiration date
- ◆ Names of room occupants
- ◆ Mailing address
- ◆ Phone and fax numbers
- ◆ E-mail

FAX:

U.S. & Canada (toll-free)
800-521-6017
Domestic & Overseas
847-940-2386

- ◆ Please print or type all items to ensure accuracy
- ◆ Complete each part below in detail for correct and rapid computer processing
- ◆ Form may be duplicated or supplemental room list must be attached using same format as below

MAIL:

Send completed form and payment to:
ICE '98 Housing Bureau
108 Wilmot Rd.
Deerfield, IL 60015

Prior to September 11, all reservations, changes, and cancellations should be submitted with the ICE '98 Housing Bureau. After September 18, contact the hotels directly regarding all changes and cancellations. Reservation deposits will be fully refundable if the cancellation is made by September 11. After September 11, a \$15 processing fee will be assessed. The deposit will be forfeited entirely if the reservation is not cancelled 72 hours prior to arrival.

2. Hotel Information

Select 4 hotels of your choice to facilitate processing. Requests are given priority in the order received. First choice is assigned IF AVAILABLE. Be sure to list definite arrival and departure dates.

1st _____ Rate _____ 3rd _____ Rate _____
 2nd _____ Rate _____ 4th _____ Rate _____

Names of Occupant(s)	Room Type* Select one	Preference Select one	Arrival Date	Departure Date
	<input type="checkbox"/> single <input type="checkbox"/> dbl/dbl <input type="checkbox"/> double	<input type="checkbox"/> smoking <input type="checkbox"/> non-smoking		
	<input type="checkbox"/> single <input type="checkbox"/> dbl/dbl <input type="checkbox"/> double	<input type="checkbox"/> smoking <input type="checkbox"/> non-smoking		
	<input type="checkbox"/> single <input type="checkbox"/> dbl/dbl <input type="checkbox"/> double	<input type="checkbox"/> smoking <input type="checkbox"/> non-smoking		
	<input type="checkbox"/> single <input type="checkbox"/> dbl/dbl <input type="checkbox"/> double	<input type="checkbox"/> smoking <input type="checkbox"/> non-smoking		
	<input type="checkbox"/> single <input type="checkbox"/> dbl/dbl <input type="checkbox"/> double	<input type="checkbox"/> smoking <input type="checkbox"/> non-smoking		

* Room Key: single (1 person, 1 bed); double (2 people, 1 bed); double/double (2 people, 2 beds).
 Requests for the New Orleans Marriott and the Riverside Hilton and Towers will be limited to 10 rooms per exhibitor company.

3. Deposit Information

A deposit of \$150 per room is required to place a reservation. The deposit will be processed by the Housing Bureau and applied to the first night's stay. Reservation deposits will be fully refundable if the cancellation is made by September 11. After September 11, a processing fee will be assessed. The deposit will be forfeited entirely if the reservation is not cancelled 72 hours prior to arrival date.

Enclosed is my check payable to ICE '98 Housing Bureau for the amount of \$ _____

Please bill my: AMEX MC Visa Diners Discover

Credit Card Number _____

Expiration Date _____

Name of Cardholder _____

Signature _____

4. Send Confirmations to:

Name: _____

Telephone: _____

Company: _____

FAX: _____

Address: _____

City/State (Province): _____

Zip Code (Mailing Code): _____

Country (if other than U.S.): _____

E-Mail: _____



_____ requires special assistance. Please attach a written description of your needs.

Registration Information

Avoid the lines.
Register by September 11
and your badge will be
mailed to you!



ICE '98 Technology Conference

October 11 – 14

FSCT Annual Meeting

October 14 – 16

ICE '98 Expo

October 14 – 16

ICE '98 Expo Hours

Wednesday, October 14
 10:00 am – 5:00 pm

Thursday, October 15
 9:00 am – 5:00 pm

Friday, October 16
 9:00 am – 12 noon

Registration Procedures

By Mail - Complete the ICE '98 Registration form and mail with payment to:

ICE '98 Registration
 P.O. Box 998
 Park Ridge, IL 60068

By Fax 24 hours a day, 7 days a week
 U.S. 800-952-9812
 International 847-698-9245

By the Internet The FSCT's ICE '98 Registration is also on-line. To register via the internet, use the address: www.coatingstech.org

If you have any questions regarding the completing of the registration forms, contact the ICE '98 Registration Help Line:

U.S. 800-823-1542
 International 847-384-7730

All cancellations and refund requests must be in writing and sent to FSCT directly. Registration cancellations received after October 9 will be processed after the convention. The cancellation deadline is October 30.

All pre-registered attendees will receive a confirmation statement of their registration selection and payment. For registrants in the U.S. who register by September 11, badges will be mailed in advance. For all registrants outside the U.S. and those who register September 12 or later, badges and materials will be available at the ICE Advance Registration Area located at the Convention Center beginning on Saturday, October 10.

Registration Options

ICE Expo/Annual Meeting----- Receive three-days admittance to the Expo and admittance to the Annual Meeting Technical program.

One-Day Course ----- Receive admittance to one ONE-DAY course along with complimentary admittance to the Expo and Annual Meeting Technical program.

Two-Day Course ----- Receive admittance to one TWO-DAY course along with complimentary admittance to the Expo and Annual Meeting Technical program.

Executive Forum ----- Receive admittance to a ONE-DAY Executive Forum program along with complimentary admittance to the Expo and Annual Meeting Technical program.

Social Guest ----- Receive three-days admittance to the Expo. Available only to the Social Guest of industry attendee.

Registration Rates

	SAVE WITH ADVANCE PRICING		ON-SITE FEES		CANCELLATION FEES	
	Mem	Non-Mem	Mem	Non-Mem	Before Oct. 2	After Oct. 2
ICE Expo/Annual Meeting Attendee	\$75	\$100	\$90	\$125	\$25	\$25
Retired Members	\$30	—	30	—	—	—
Students	15	15	15	15	—	—
Social Guests*	25	25	25	25	—	—
One-Day Course	295	395	345	445	50	100
Two-Day Course	495	595	545	645	50	100
Executive Forum	695	795	745	845	50	100

*Fees do not include tours.



Do Not Use This Form After October 2, 1998

ICE '98, PRE-REGISTRATION FORM

October 11-16, 1998, New Orleans, LA



For regular pre-registration, this form must be postmarked no later than OCTOBER 2, 1998. Form must be filled out completely for processing. A confirmation of your registration will be sent to you. ICE badges must be worn for admission to the ICE exhibits and all Conference courses.

STEP 1. Industry Attendee Badge Information

FIRST NAME (Nickname) _____

FIRST NAME _____ LAST NAME _____

COMPANY _____

MAILING ADDRESS (or P.O. Box) _____

CITY _____ STATE/PROV. _____

COUNTRY (other than U.S.) _____ POSTAL CODE _____

TELEPHONE NO. _____ FAX NO. _____

STEP 2. Registrant Profile

Are you a first-time attendee?
1 Yes 2 No

FSCT Society Affiliation _____

Information below must be completed for registration to be processed:

Your Company (Check one only)

31 Manufacturers of Paints, Varnishes, Lacquers
32 Manufacturers of Printing Inks
33 Manufacturers of Sealants, Caulks, Adhesives
34 Manufacturers of Powder Coatings
35 Manufacturers of Raw Materials
36 Manufacturers of Equipment and Containers
37 Sales Agents for Raw Materials and Equipment
38 Government Agency
39 Research/Testing/Consulting
40 Educational Institution
41 Paint Consumer

42 Environmental Services
43 Other _____

Your Position (Check one only)

51 Management/Administration
52 Mfg. & Engineering
53 Quality Control
54 Research & Development
55 Technical Sales Service
56 Sales & Marketing
57 Consultant
58 Educator/Student
59 Other _____

STEP 3. Social Guest Badge Information

FIRST NAME (Nickname) _____ FIRST NAME _____ LAST NAME _____

CITY _____ STATE/PROV. _____

COUNTRY (other than U.S.) _____

Social Guest Registration
(Welcome Social and Expo) \$25

Optional Tours Available (See Step 5)

YES! Have CMS Travel call me about discount airfares to New Orleans! 800-323-4961

STEP 4. Conference Registration:

Conference registrants must check boxes of session they wish to attend (Not more than one box per day)

Sunday, Oct. 11	Monday, Oct. 12	Tuesday, Oct. 13	Wednesday, Oct. 14
ONE-DAY COURSES <input type="checkbox"/> D1 SPRAY APPLICATIONS <input type="checkbox"/> D2 NEGOTIATING SKILLS <input type="checkbox"/> D3 POWDER COATINGS <input type="checkbox"/> D4 FINANCE FOR NON-FINANCIAL MGR.	ONE-DAY COURSES <input type="checkbox"/> D5 INK TECHNOLOGY <input type="checkbox"/> D6 CORROSION <input type="checkbox"/> D7 MANAGEMENT SKILLS <input type="checkbox"/> D8 TECHNICAL WRITING	ONE-DAY COURSES <input type="checkbox"/> D9 SURFACTANT CHEMISTRY <input type="checkbox"/> D10 MARINE COATINGS <input type="checkbox"/> D11 TECHNICAL PRESENTATIONS	EXECUTIVE FORUM <input type="checkbox"/> F2 GLOBAL COMMERCIALIZATION
TWO-DAY COURSES (Oct. 11-12) <input type="checkbox"/> E1 BACK TO BASICS (day 1)	TWO-DAY COURSES (Oct. 12-13) <input type="checkbox"/> E1 BACK TO BASICS (day 2) <input type="checkbox"/> E2 RADIATION CURING (day 1) <input type="checkbox"/> E3 CROSSLINKING (day 1)	TWO-DAY COURSES (Continued) <input type="checkbox"/> E2 RADIATION CURING (day 2) <input type="checkbox"/> E3 CROSSLINKING (day 2)	NOTE: Registration is limited for many courses. Provide alternate selections (put an X over appropriate choice/s): one-day courses: (D1) (D2) (D3) (D4) (D5) (D6) (D7) (D8) (D9) (D10) (D11) two-day courses: (E1) (E2) (E3) executive forums: (F1) (F2)
For Office Use Only B/N _____ R _____ P _____ C _____ E _____	EXECUTIVE FORUM <input type="checkbox"/> F1 NEW PRODUCT DEVELOPMENT		

STEP 5. Calculate Amount

ADVANCE PRICING (deadline October 2)			
	FSCT member	nonmember	amount
ICE EXPO/ANNUAL MTG. ONLY			
Retired Members	\$75 A1PA	\$100 A2PA	\$ _____
Students	\$30 B1PA	\$15 C1PA	\$ _____
TECHNOLOGY CONFERENCE:			
One-Day Course	\$295 D1PA	\$395 D2PA	\$ _____
	X _____ no. of 1-day courses selected		\$ _____
Two-Day Course	\$495 E1PA	\$595 E2PA	\$ _____
	X _____ no. of 2-day courses selected		\$ _____
Executive Forum	\$695 F1PA	\$795 F2PA	\$ _____
	X _____ no. of Exec. Forum courses selected		\$ _____
SOCIAL GUESTS	\$25 G2PA		\$ _____
Optional Tours: (Select ONLY one per day):			
Wed. Jazz Tour	\$45 H1PA		\$ _____
Wed. French Quarter	\$30 H2PA		\$ _____
Thurs. Covington	\$70 H3PA		\$ _____
Thurs. Plantations	\$45 H4PA		\$ _____
Thurs. Garden District	\$30 H5PA		\$ _____
Total for Tours			\$ _____
TOTAL REGISTRATION PAYMENT DUE			\$ _____

STEP 6. Method of Payment

(Make check payable in U.S. Funds to FSCT)

SELECT ONE: Check enclosed MasterCard
 VISA American Express

Card number: _____

Exp. date: month _____ year _____

Cardholder's name _____ please print

Signature: _____

Amount Enclosed (from Step 5) \$ _____

REGISTER TODAY!

By Fax: USA (800) 952-9812
International (847) 698-9245

By Mail send to: ICE Registration,
P.O. Box 998,
Park Ridge, IL 60068 USA

ICE '98 Registration Helpline (between 9:00 am and 5:00 pm CST)
USA (800) 823-1542
International (847) 384-7730

Avoid duplication of registration: if you fax your registration, please do NOT mail it.

ice'98
INTERNATIONAL
COATINGS EXPO

Exhibitors

(as of 4/24/98)

Aceto Corp.
ACT Laboratories
ACTI-Chem Specialties, Inc.
Advanced Software Designs
Air Products & Chemicals, Inc.
Akzo Nobel Resins
Alar Engineering Corp.
AlliedSignal Inc.
Alnor Oil Co.
American Chemical Society
American Colors, Inc.
Amer. Paint & Coatings Journal
Amoco Chemicals
ANGUS Chemical Co.
Anker Labelers USA Inc.
Aqualon, A Div. of Hercules Inc.
ARCO Chemical Co.
Arizona Instrument Corp.
Ashland Chemical Co. Drew
Industrial Div.
Atlas Electric Devices Co.
Atotech USA Inc
Automation USA
Avestin Inc.
Aztec Peroxides, Inc.
B.A.G. Corp.
BASF Corp.
BatchMaster Software, Inc.
Blacoh Fluid Control, Inc
Bohlin Instruments, Inc.
Borden Inc.
Bowers Process Equipment Inc.
Brookfield Engineering Labs., Inc.
Buckman Laboratories, Inc.
Bulk-Pack, Inc.
Bulkcon Systems USA
Burgess Pigment Co.
BYK-Chemie USA
BYK-Gardner, Inc.
Cabot Corp., CAB-O-SIL &
Special Blacks Div.
Calgon Corp.
Cardolite Corp.
CB Mills
CEM Corp.
Charles Ross & Son Co.
Chem-Tel Inc.
Chemical Market Report
Chemidex Inc.
Ciba Specialty Chemicals Corp.
Additives, Pigments, &
Polymers Divs.
Cimbar Performance Minerals

Clariant Corp.
Clawson Container Co.
CMI International
Color Communications, Inc.
Color Corp. of America
Columbian Chemicals Co.
Corab North America Div.
Cartec Corp.
CR Minerals Corp.
Cray Valley
Creanova Inc. (Hüls America Inc.)
Crosfield Co.
Cuno, Inc.
D/L Laboratories
Datacolor International
Defelsko Corp.
Degussa Corp.
Della Colours
DMG Business Media Ltd.
Dominion Colour Corp.
Dover Chemical Corp.
Dow Chemical Co.
Dry Branch Kaolin Co.
DuPont Nylon Intermediates &
Specialties
DuPont Performance Chemicals
Eagle Zinc Co.
Ebonex Corp.
ECC International
Eckart America
Eiger Machinery, Inc.
Elementis
Elf ATOCHEM North America
Engelhard Corp.
Engineered Polymer Solutions
Erie Chemical Sales
Estron Chemical, Inc.
Exxon Chemical Co.
Fawcett Co., Inc.

Federation of Societies for Coatings Technology

Ferro Corp.
First Chemical Corp.
Fischer Technology Inc.
Florida Drum Co.
Floridin Co., Div. of ITC
Industrials
Fluid Management
Formation Systems, Inc.
Franklin Industrial Minerals
Fuji Silysia Chemical
H.B. Fuller Co.
Gamry Instruments, Inc.
Paul N. Gardner Co., Inc.
Georgia Marble Co.
Georgia-Pacific Resins, Inc.
Gilson Co., Inc.
BFGoodrich Co. Specialty
Chemicals
The Goodyear Tire & Rubber Co.
Grace Davison
Gretag/Macbeth
Guertin Polymers
H.G. Feldmann GmbH
Halox Pigments
Hansotek, Inc.
Heisler Industries, Inc.
Henkel Corp.
HERO Industries Limited
Heucotech Ltd.
Hi-Mar Specialties, Inc.
Hockmeyer Equipment Corp.
Hoover Materials Handling
Group, Inc.
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J.M. Huber Corp. Engineered
Minerals Div.
HunterLab
Huntsman Corp.
ICI Paints
ICI Surfactants
Ideal Mfg. & Sales Corp.
Indco, Inc.
Industrial Oil Products
Industrial Paint & Powder
INOUE USA
Interfibe Corp.
Intl. Specialty Products (ISP)
Italtinto America Inc.
ITT Marlow/ITT A-C Pump
SC Johnson Polymer
**Journal of Coatings
Technology**
Kelly Chemical Corp.
Kenrich Petrochemicals, Inc.
King Industries, Inc.
Kline & Co., Inc.
Kowa American Co.
KTA-Tator, Inc.
Labelmaster
Langguth GmbH
LANSCO Colors
Laporte Pigments
LaQue Corrosion Services
Lawter International
The Leneta Co.
Liquid Controls Corp.
Littleford Day Inc.
Loeffler Filtration Group
Longview Fibre Co.
3M Performance Chemicals
Mallinckrodt Inc. Trimet Technical
Products Div.
Malvern Minerals Co.
Michelman, Inc.
Micro Powders, Inc.
Microfluidics International Corp.
Micromeritics
Ming-Zu Chemical Industries
Minifibers, Inc.
Minolta Corp.
Mississippi Lime Co.
Morton International
Muetek Analytic Inc.
Myers Engineering
Nacan Products Ltd.
Nametree Co.
Neste OXO AB
Netszch Incorporated
Neupak, Inc.
Nichep Corp.
Nissan Chemical America Corp.
Norman International
North Dakota State University
NYCO® Minerals, Inc.
Oak Printing Co.
Occidental Chemical Corp.
Ocean Optics, Inc.
Ohio Polychemical Co.
Olin Corp.
Omnimark Instrument Corp.
Paar Physica, USA Inc.
Paint Research Association
Parasol Systems, Inc.
Particle Sizing Systems, Inc.
Peninsula Polymers
Phenoxo Specialties
Pioneer Packaging Machinery
Polar Minerals
Poly-Resyn, Inc.

PQ Corp./ Potters Industries
Premier Mill Corp.
Priority One Packaging
Purity Zinc Metals
Q-Panel Lab Products
K.J. Quinn & Co., Inc.
Raabe Corp.
Ralston Colour Systems & Ctgn.
Ranbar Technology, Inc.
Readco Manufacturing, Inc.
Reichhold Chemicals, Inc.
Revelli Chemicals, Inc.
Rhodia, Inc.
Rohm and Haas Co.
Ronningen-Petter
Russell Finex, Inc.
San Esters Corp.
Sartomer Co.
Schenectady International, Inc.
Polymer Div.
Schlumberger Industries
SEPR Ceramic Beads & Powders
Shamrock Technologies, Inc.
Shell Chemical Co.
Siber Hegner North America
Silberline Mfg. Co., Inc.
Sivento Inc.
Solutia Inc. (formerly Monsanto)
Southern Clay Products, Inc.
University of Southern Mississippi
Specialty Minerals, Inc.
Spectratek Corp.
Startex Chemical, Inc.
Stony Brook Scientific Ltd.
Sud-Chemie Rheologicals
Sun Chemical Corp.
TA Instruments, Inc.
Taber Industries
Tayca Corp.
Tech Pak, Inc.
Teemark Corp.
Tego Chemie Service USA
Thomas Scientific
Tikkurila & McWhorter CPS
TNT Container Logistics
Toyol America, Inc.
Troy Corp.
U.S. Aluminum, Inc.
U.S. Filter/Filterite
U.S. Zinc Corp.
Ultra Additives, Inc.
Unimin Corp.
Union Carbide Corp.
Union Process Inc.
United Mineral & Chemical Corp.
United Soybean Board
Van Waters & Rogers, Inc.
VanDeMark Group
R.T. Vanderbilt Co., Inc.
Versa-Matic Pump Co.
Vianova Resins Inc.
Vicallic Co. of America
Viking Pump, Inc.
Viskonal-Aire
Vorti-Siv Div. MM Industries, Inc.
Waardale Kjemiske Fabrikker A/S
Wacker Silicones Corp.
Warren Rupp, Inc. Unit of IDEX
Corp.
Western Equipment Co.
Wilden Pump & Engineering Co.
Witco Corp.
X-Rite, Incorporated
Zemex Industrial Minerals
Zeneca Resins/Zeneca Biocides

Regulatory Update

Federal Regulations
State Regulations
International Activity
Update Analysis

May 1998

This summary of current regulatory activity of interest to the coatings industry is published to inform readers of actions that could affect them and their firms, and is designed to provide sufficient data to enable those interested to seek further information. Material is supplied by the law firm of Swidler & Berlin, Chartered, in Washington, D.C. Although reasonable steps have been taken to ensure the reliability of this Regulatory Update, the FSCT and Swidler & Berlin cannot guarantee its completeness or accuracy.

Federal Regulations

Final Regulations

Environmental Protection Agency

March 16, 1998 - 63 FR 12652

Action: Withdrawal of direct final rule

Subject: Identification of ozone areas where the one-hour standard is no longer applicable

On January 16, 1998, EPA published a proposed rule (63 FR 2804) and a direct final rule (63 FR 2726) announcing EPA's decision to identify areas where the one-hour National Ambient Air Quality Standard (NAAQS) for ozone is no longer applicable because there has been no current measured violation of the one-hour standard in such areas. (See the March 1998 *Regulatory Update* for more information on the direct final rule.) EPA has withdrawn the direct final rule due to adverse comments and will summarize and address all relevant public comments received in a subsequent final rule (to be based on the proposed rule cited above).

For further information, contact Annie Nikbaht (policy) or Barry Gilbert (air quality data), Office of Air Quality Planning and Standards, Air Quality Strategies and Standards Division, Ozone Policy and Strategies Group, MD-15, Research Triangle Park, NC 27711, phone: (919) 541-5246/5238.

Environmental Protection Agency

March 27, 1998 - 63 FR 15006

Action: Final rule and release of final control techniques guidelines (CTG) document

Subject: NESHAPs for aerospace manufacturing and rework facilities

EPA has finalized several amendments to the national emission standards for hazardous air pollutants (NESHAP) for aerospace manufacturing and rework facilities. These amendments include, among other things, revision of standards for new and existing sources using dry particulate filters to control emissions from topcoat and primer application and repainting operations; addition of an exemption for certain water-reducible coatings; addition of an exemption from inorganic HAP requirements for hand-held spray can applications; clarification of the applicability of new source MACT to spray booths; revision of the requirements for new and existing primer and topcoat application operations; addition of definitions for specialty coatings; and revision of the standard for repainting operations. The amendments were effective March 27, 1998. EPA also finalized a control techniques guideline released in an October 1996 draft.

For further information, contact Barbara Driscoll, Policy Planning and Standards Group, Emission Standards Division (MD-13), U.S. EPA, Research Triangle Park, NC 27711; telephone (919) 541-0164.

Environmental Protection Agency

April 9, 1998 - 63 FR 17331

Action: Final rule

Subject: Exclusion of Methyl Acetate from the definition of Volatile Organic Compounds

This action revises EPA's definition of volatile organic compounds (VOC) for purposes of preparing State Implementation Plans (SIPs) to attain the NAAQS for ozone under title I of the Clean Air Act. This revision adds methyl acetate to the list of compounds excluded for the definition of VOC on the grounds that it has a negligible contribution to tropospheric ozone formation. Methyl acetate has potential for use as a solvent in paints, inks and adhesives. The rule is effective May 11, 1998.

For further information, contact William Johnson, Office of Air Quality Planning and Standards, Air Quality Strategies and Standards Division (MD-15), Research Triangle Park, NC 27711; telephone (919) 541-5245.

Proposed Regulations

Environmental Protection Agency

March 23, 1998 - 63 FR 13810

Action: Proposed rule (and direct final rule)

Subject: Approval of Illinois SIP revisions on VOC emissions from chemical manufacturing

EPA is proposing to approve revisions to the Illinois SIP regarding rules for controlling Volatile Organic Material (VOM) emissions from Synthetic Organic Chemical Manufacturing Industry (SOCMI) reactor processes and distillation operations in the Chicago and East St. Louis areas. (The state's definition of VOM is identical to EPA's definition of VOC.) Because EPA views this as a noncontroversial action and anticipates no adverse comments, it is simultaneously approving the revisions as a direct final rule (at 63 FR 13784). If no adverse comments are received, the direct final rule will become effective May 22, 1998. If adverse comments are received, the direct final rule will be withdrawn and EPA will address the comments in a subsequent final rule based on the proposed rule. Comments were due by April 22, 1998.

For further information, contact Mark J. Palermo, Environmental Protection Specialist, Regulation Development Section, Air Programs Branch (AR-18J), EPA

Region 5, 77 West Jackson Boulevard, Chicago, Illinois 60604; telephone (312) 886-6082.

Environmental Protection Agency

March 31, 1998 - 63 FR 15345

Action: Proposed rule (and direct final rule)

Subject: Extension of compliance with NESHAP for producers of poly(ethylene terephthalate)

On September 12, 1996, EPA published the Group IV Polymers and Resins NESHAP (61 FR 48208). EPA is now proposing to extend the compliance date specified in the NESHAP for existing affected sources producing poly(ethylene terephthalate) (PET) using the continuous terephthalic acid (TPA) high viscosity multiple end finisher process because EPA is in the process of responding to a request to reconsider relevant portions of the rule. EPA is simultaneously issuing the compliance date extension (from September 12, 1999 to February 27, 2001) as a direct final rule (at 63 FR 15312). If no adverse comments are received, the direct final rule will become effective May 20, 1998. If adverse comments are received, the direct final rule will be withdrawn and EPA will address the comments in a subsequent final rule based on the proposed rule. Comments were due by April 30, 1998.

For further information, contact Robert Rosensteel, Emission Standards Division (MD-13), EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711; telephone (919) 541-5608.

Occupational Safety and Health Administration

April 7, 1998 - 63 FR 16918

Action: Proposed rule

Subject: Dipping and coating operations

OSHA is proposing to revise its rules for dipping and coating operations. The revisions would rewrite the rules in plain language; consolidate them in several new sequential sections of subpart H of part 1910; and update them to increase the compliance options available to employers. Comments on the proposed rule are due by June 8, 1998.

For further information, contact Terrence Smith, Office of Fire Protection Engineering and System Safety Standards, Room N-3609, OSHA, U.S. Dept. of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210; telephone (202) 219-7216.

Notices

Environmental Protection Agency

March 25, 1998 - 63 FR 14392

Action: Notice of Availability of Draft Rules

Subject: Clean Air Act Part 70 Operating Permits Program

On March 25, EPA issued for public review and comment the draft preamble and draft revisions to the Clean Air Act Part 70 operating permits program regulations. These revisions include regulatory provisions dealing with definitions, applicability, permit applications, and permit content. The proposal makes changes to: the definition of major source with respect to research and development activities, support facilities, and fugitive emissions; compliance certification language; and the emergency defense. The package also contains revised procedures for minor NSR permitting. The draft revision package does not include provisions concerning permit revisions or permit review by EPA, affected states, and the public. These issues are the subject of stakeholder discussions and are expected

to be addressed in a subsequent rulemaking. Comments on the draft rules were due by April 24, 1998.

For further information, contact Ray Vogel, telephone (919) 541-3153, or Ray Powell, telephone (919) 541-5331. The address for both contacts is U.S. EPA, Mail Drop 12, Information Transfer and Program Integration Division, Research Triangle Park, NC 27711.

Environmental Protection Agency

April 3, 1998 - 63 FR 16502

Action: Notice of open meeting

Subject: Photochemical reactivity

EPA is holding a three-day open meeting to discuss the concept of photochemical reactivity as it relates to control of VOCs for the attainment of the ozone NAAQS. EPA is in the process of reviewing its 1977 photochemical reactivity policy to ensure that it is consistent with current scientific findings. The focus of the meeting will be to identify scientific issues where further research is needed and how this research may be carried out. The meeting will be held on May 12-14, 1998 from 8:30 to 5:00 in Durham, NC.

For further information, contact, Dr. Basil Dimitriadis, National Exposures Research Laboratory, Mail Drop 80, U.S. EPA, Research Triangle Park, NC 17711; telephone (919) 541-2706.

Federal Legislation

Superfund

Prospects for a broad reauthorization of the Superfund statute look slim for 1998. Huge policy differences remain, particularly on liability and remedy selection issues, and few legislative days are left in the session. Moreover, members of Congress will be increasingly unwilling to take positions on controversial issues prior to the November elections. The current Senate bill (S.8) was approved by the Senate Environment and Public Works Committee on March 26. A House bill (HR 2727) introduced by Rep. Sherwood Boehlert (R-NY) was approved by the House Transportation and Infrastructure Subcommittee on Water Resources and Environment. Both of these bills lack Democrat support in Congress, and President Clinton has indicated that he would not sign the bills pending in Congress.

A group of House Commerce Committee Democrats, led by Reps. John Dingell (D-MI) and Tom Manton (D-NY) introduced a Superfund Reauthorization bill on March 30. Sources say, however, that any further action by the Commerce Committee on Superfund this year is unlikely. Democrats are considering efforts to push a narrow Superfund bill that would include brownfields provisions and narrow liability fixes for small businesses and generators of small amounts of municipal waste. Such an effort could come soon after the April recess.

Clean Air Act

Congress' year-long dispute over the EPA's new emission standards for ozone and particulate matter appears to be resolving under a compromise plan. Under the plan, EPA's rulemaking will not be altered, but the legality of the Agency's extended implementation plan will be ensured. The compromise legislation was

attached to the Senate surface transportation bill (S. 1173) in March. The plan has two main components: First, EPA's extended implementation plan for the fine particulate matter standard of 2.5 microns will be statutorily set. Second, the amendment directs EPA to absorb in full the cost for states to establish new monitoring systems for fine particulates. Rep. Bob Ney (R-OH) is considering offering an amendment to the House's surface transportation bill (H.R. 2400) that would reflect the Senate compromise.

OSHA

Several OSHA reform bills have been introduced in Congress in the past months. Rep. Cass Ballenger (R-NC) has introduced at least six bills: One bill, HR 2869, would protect the results of a company's own voluntary safety audits from being used by OSHA in an enforcement case; another, HR 2871, would mandate outside peer review of OSHA safety and health standards; another, HR 2879, would clarify responsibility of employers on multi-employer work sites; the fourth, HR 2877, would bar OSHA from using citation or inspection quotas; the fifth would codify OSHA's current employer consultation program; and the sixth, HR 2873, would require OSHA to conduct a cost-benefit analysis to determine how each specific industry would be affected by a safety and health standard.

Reps. Kay Granger (R-TX) and Tim Roemer (D-IN) introduced legislation (HR 3519) that would allow employers to maintain electronic versions of MSDSs rather than paper copies.

Two bills, HR 2579 and S. 1237, would allow business owners to hire outside safety consultants to inspect the workplace. If the consultant certifies that the workplace is in compliance with OSHA, the employer would be exempt for two years from civil fines for OSHA violations. OSHA inspections could still take place during the two-year period.

OSHA and EPA

On March 26, the House approved a measure (HR 3310) that would bar federal agencies, including EPA and OSHA, from issuing fines against small employers for most first-time violations of federal paperwork requirements. For OSHA-related enforcement, the bill would ensure that the penalty exemption is extended to the 23 states that administer their own OSHA-approved job safety enforcement programs. A similar bill has yet to be introduced in the Senate.

Current News and Upcoming Federal Developments

EPA finalizes consumer products VOC rule

The EPA has finalized and sent to the Office of Management and Budget for review its rule to reduce VOC emissions from dozens of household products. The rule, which along with the rules for architectural and maintenance coatings and autobody coatings is expected to be promulgated by August 15, is designed to reduce VOC emissions from these products by 20 percent. The final rule is almost identical to the rule proposed in April 1996. The rule will require manufacturers, importers and distributors of the affected products to limit the VOC levels of their products. Among the household products included within the rule are

household adhesives (aerosols, contact, construction and panel, general purpose, and structural waterproof), fabric protectants, floor polishes and waxes, and furniture maintenance products.

EPA launches first voluntary electronic TSCA reporting system

EPA has instituted the first voluntary program under which chemical manufacturers may file reports electronically to meet TSCA reporting requirements. The program, called the Voluntary Information Submission Electronic Gathering Reporting Information Process, or VISEGRIP, will make the reports available to the public on the Internet at <http://www.epa.gov/opptintr/itc>. The goal is to have the reporting system replace the TSCA Section 8(d) rule.

Sector Facility Indexing Project database available

EPA announced in late March that its Sector Facility Indexing Project (SFIP) database would become available in early April. The database contains the environmental compliance records of 655 facilities in five industrial sectors — auto assembly, iron and steel, petroleum refining, nonferrous metals, and paper mills. EPA has stated that the project may be extended to cover other industrial sectors in the future. The database provides a summary of each facility's environmental compliance status for the last eight quarters, and provides electronic links to research detailed information on the nature and extent of the noncompliance. Unlike earlier versions of the database, the database that is available to the public will not include numbers representing the relative toxicity of each facility's chemical releases. In addition, the population surrounding each facility will be profiled in greater detail, including statistics for "percent minority" and "percent poverty." The SFIP database is available on the World Wide Web at: <http://es.epa.gov/oeca/sfi/index.html>.

State Regulations

ALABAMA

Air Quality (Final Rule)—The Alabama Department of Environmental Management (ADEM) has revised the Environmental Management Commission's regulations at AAC 335-3-14 through 335-3-17 by changing the definition of Volatile Organic Compound to conform to changes in Federal mandates and requirements. The revised definition became effective March 27, 1998. For further information, contact Olivia H. Jenkins, ADEM, Environmental Management Commission, PO Box 301463, Montgomery, AL 36130-1463.

CALIFORNIA

Air Quality (Proposed Rule)—The California Air Resources Board (CARB) has proposed new rules governing minor violations, at 17 CCR 60090-60095. The new rules would provide that emission violations which the Board's Executive Officer or delegated enforcement staff considered to be *de minimis* in quantity would be classified as minor violations. However, violations which increased emissions of air toxics would not be considered minor violations. The *de minimis* determination would be made on a case-by-case basis, not by defining specific *de minimis* amounts in the rules. Com-

ments were due April 22, 1998; a hearing was scheduled for April 23, 1998. For further information, contact the Clerk of the Board, CARB, (916) 323-8412.

Hazardous Waste (Proposed Rule)—The California Department of Toxic Substances Control (DTSC) is proposing new definitions under the Hazardous Waste Control Act at 22 CCR 66260.10. The proposed rule would define the terms "etchant," "plating solution," "stripping solution," and "originally purchased or manufactured purpose" to clarify the recycling restriction imposed by Health & Safety Code Sec. 25143.2. Comments are due May 14, 1998 and a hearing is also scheduled for May 14, 1998. For further information, contact Joan Ferber, DTSC, (916) 324-9933.

DELAWARE

Air Quality (Proposed Rule)—The Delaware Department of Natural Resources and Environmental Control (DNREC) has proposed additional revisions to its uncodified Regulations regarding emission standards for hazardous air pollutants for source categories. Comments were due April 27, 1998 and a hearing was also scheduled for April 27, 1998. For further information, contact DNREC, (302) 739-4791.

IDAHO

Air Quality (Temporary Rule)—The Idaho Department of Health and Welfare (DHW) has promulgated temporary air toxics rules at IDAPA 16.01.01. The rules implement the federal program established under Sections 112(g) and 112(j) of the Clean Air Act, and establish a Maximum Achievable Control Technology (MACT) standard for new major sources that emit hazardous air pollutants. The temporary rules became effective April 15, 1998. For further information, contact Tim Teater, DHW, (208) 373-0502.

ILLINOIS

Environmental Management Systems (Final Rule)—The Illinois Environmental Protection Agency (IL-EPA) has adopted new regulations at 35 IAC Part 185 establishing a pilot program for Regulatory Innovation Projects. The program would allow companies or "sponsors" to propose, and IL-EPA to accept pursuant to an Environmental Management System Agreement, pilot projects to implement innovative environmental measures, even if such measures would be inconsistent with otherwise applicable environmental statutes or regulations of the state. The rules became effective March 20, 1998. For further information, contact IL-EPA at (217) 782-5544.

LOUISIANA

Hazardous Substances (Proposed Rule)—The Louisiana Department of Environmental Quality (DEQ) has proposed to revise its rule on the reportable quantities list for hazardous substances at LAC 33:L.3931. The proposed rule would replace the state Reportable Quantity List for Pollutants with an incorporation by reference to the corresponding federal lists. Incorporation of the federal lists would add an additional 361 compounds and adjust the reporting thresholds for 81 compounds in Louisiana's regulations. Comments were due April 27, 1998 and a hearing was also scheduled for April 27, 1998. For further information, contact Patsy

Deaville, Investigations and Regulation Development Division, DEQ, (504) 765-0399.

MAINE

Air Quality (Final Rule)—The Maine Department of Environmental Protection (DEP) has amended its Surface Coating Facilities Rules at Me. R. 06-96-129 to simplify compliance for smaller facilities. The amended provisions include: a *de minimis* threshold exempting smaller sources from regulations; reduced recordkeeping requirements; facility exemptions and other incentives for the use of powder coatings or other non-VOC coating methods; and the exemption of coatings used on-site for maintenance repair or refinishing of equipment used on-site. The rules also define appropriate work practices for the use of VOC-based solvents for cleanup (with an exemption for the aerospace manufacturing sector). The rules became effective March 3, 1998. For further information, contact Jeffrey Crawford, DEQ, (207) 287-2437.

MASSACHUSETTS

Hazardous Waste (Proposed Rule)—The Massachusetts Department of Environmental Protection (DEP) has proposed to amend the Massachusetts Contingency Plan at 310 CMR 40 to clarify rules regarding standards in the Massachusetts Oil and Hazardous Material List and the Upper Concentration Limits table. Comments were due April 17, 1998; a hearing was scheduled for April 7, 1998.

MINNESOTA

Air Quality (Proposed Rule)—The Minnesota Pollution Control Agency (MPCA) has proposed to amend its regulations on air emission permits. The amendments relate to preconstruction review requirements for certain major hazardous air pollutant sources. Comments are due May 13, 1998. For further information, contact Onsoon Berglund, MPCA, (612) 296-7595.

MISSOURI

Air Quality (Final Rule)—The Missouri Department of Natural Resources (DNR) has amended its construction permit regulations at 10 CSR 10-6.060. The amended provisions require that emissions of toxic air pollutants not increase if a facility is constructed or reconstructed before EPA issues a MACT standard or air toxics regulation for that source category or facility category. The amendment became effective April 30, 1998. For further information, contact the Chief, Planning Section, Air Pollution Control Program, 205 Jefferson St., PO Box 176, Jefferson City, MO 65102.

NEW JERSEY

Hazardous Substances (Proposed Rule)—The New Jersey Department of Environmental Protection (DEP) has proposed to readopt, with amendments, its Toxic Catastrophe Protection Act rules at NJAC 7:31, which are due to expire on June 18, 1998. The proposed amended readoption would incorporate by reference the Federal Accidental Release Prevention requirements with modifications to ensure that the state rules include all federal requirements. The amendments would also expand the list of regulated substances by adding

federally listed toxic and flammable substances. Comments were due April 15, 1998; a hearing was scheduled for March 30, 1998. For further information, contact Ann Zeloof, Office of Legal Affairs, DEP, 401 East State St., PO Box 402, Trenton, NJ 08625.

OREGON

Hazardous Materials Transportation (Final Rule)—The Oregon Department of Transportation (ODOT) has amended its regulations on Hazardous Materials Transportation at OAR 740-100-0010 through 740-100-0100. The amendments are intended to ensure that Oregon's requirements are consistent with national and international standards. Provisions of the amended rules cover the adoption of federal statutes relating to hazardous materials; motor carrier safety; and driver, vehicle and hazardous materials out-of-service standards and uniform bail schedule. The amended rules became effective April 1, 1998. For further information, contact Brenda Trump, ODOT, (503) 945-5278.

TEXAS

Air Quality (Final Rule)—The Texas Natural Resource Conservation Commission (TNRCC) has amended its regulations under 30 TAC Ch. 115 concerning surface coating processes and has added rules on wood furniture coating and shipbuilding repair coating to its VOC emission regulations under Chapter 115. The rules became effective April 7, 1998. For further information, contact Lisa Martin, TNRCC, (512) 239-1488.

International Activity

AUSTRIA

New hazardous waste law

A new Austrian ordinance that is designed to make it easier for industries to identify their hazardous wastes went into effect on March 1. The new ordinance eliminates the confusion existing in recent years due to the existence of several different systems from identifying wastes. The ordinance includes a detailed list of wastes with their associated waste codes. The ordinance also adds several new categories of hazardous waste in order to conform with European Union law.

CZECH REPUBLIC

Major new environmental law

A major piece of environmental legislation, the Act on Chemical Substances and Preparations, was enacted by the Czech Parliament in March and is expected to be signed by president Havel. The Act will go into effect on July 1, 1998. This legislation is the first Czech law to comprehensively address the effects of chemicals on humans and the environment. The law shifts responsibility for chemical regulation from the Ministry of health to the Ministry of Environment. It establishes a system for regulating the import and export of chemicals, the certification of people allowed to handle chemicals, and the use of dangerous substances. The law also requires companies to disclose information about the chemicals stored at facilities.

Increased wastewater discharge fees

The Czech Parliament passed a bill, the Act on Fees

for Discharging Waste Water to Surface Water, which will go into effect on January 1, 1999 if signed by President Havel as expected. The law will increase industrial wastewater discharge fees by more than 100 percent by 2002. The fee increases will be phased in from 1999 to 2002. The law was intended to encourage companies and municipalities to build wastewater treatment plants to treat their wastewater rather than simply paying "polluter fees."

EUROPEAN UNION

More stringent VOC standards

The European Union Council of Environmental Ministers reached an agreement on March 23 to impose more stringent VOC limits on industry. The directive is designed to reduce emissions by 50 percent by 2010 compared to 1990 levels. It defines emission reduction targets by means of emission limit values to be reached either through abatement at the source by using appropriate end-of-pipe technology or clean technology. The directive requires member states to draw up VOC reduction plans tailored to their own national circumstances.

MEXICO

New strategy for environmental enforcement

Mexico is in the process of changing its system for inspecting facilities and monitoring compliance with environmental laws. The country has received a \$39 million loan from the World Bank which it will use in part to develop a computerized information system to track industrial compliance. The country plans to replace in part its current intensive inspection efforts with a system of self-auditing and self-reporting. The government intends eventually to release detailed information about individual companies to the public.

ISO 14000 certification process

Mexico announced in late March that it should be ready by mid-1998 to operate its certification organization for ISO 14000. The government is about to approve one or two organizations that will be in charge of certifying agencies that, in turn, will be authorized to assess and certify ISO 14000 compliance.

FORMER SOVIET UNION

Proposed loan guarantees for environmental projects

The U.S. EPA has proposed to offer loan guarantees for environmental projects to the newly independent states of the former Soviet Union. According to EPA's proposal, a \$100 million fund over ten years would guarantee up to \$3 billion in municipal bonds for environmental infrastructure projects, such as drinking water plants, waste water collection and treatment systems, solid or hazardous waste disposal facilities, and abatement of air pollution. The possible loan guarantee program is currently under discussion within the U.S. government executive branch.

SPAIN

New law on wastes

The Spanish Parliament on April 2 approved a new law on wastes, five years after the European Union's 1993 deadline for member states to adopt such legislation. The new law applies to all types of waste, but

does not address air pollution, radioactive wastes, or water pollution, which are governed by separate laws. The law requires Spain's 17 regional governments to make an inventory of polluted soil within their jurisdictions and to take action to clean it up. The law establishes fines of up to 200 million pesetas (\$1.3 million) for serious infractions. Greenpeace España has criticized the law, because it allows for waste incineration and the transfer of wastes from one Spanish region to another, lessening the incentive to reduce wastes at the point of origin.

SWEDEN

New environmental code

The Swedish Parliament is currently debating a new comprehensive environmental code that would merge existing laws into a single law and strengthen numerous environmental protection measures. The new law would create an integrated system for environmental permitting, and would formalize the "polluter pays," precautionary, and substitution principles, all of which hold companies responsible for minimizing environmental impacts from their operations.

Update Analysis: OSHA's New Hazard Communication Compliance Directive

On March 20, OSHA issued a new hazard communication compliance directive, CPL 2-2.38D, that replaces the guidance that has been in place since 1990. The purpose of the directive is to ensure uniform enforcement of the Hazard Communication Standard (29 C.F.R. § 1910.1200). The directive consolidates interpretations issued since the 1990 document, covers technical amendments and clarifications to the standard that were adopted in a February 1994 rulemaking, and addressed issues raised in the September 1996 report to OSHA on hazard communication submitted by the National Advisory Committee on Occupational Safety and Health.

The directive, among other things, clarifies that employers may provide MSDSs to workers through electronic means, including computers, microfiche, the Internet, CD-ROM, and fax. Employers that use electronic means to provide MSDSs must ensure: that reliable devices are available in the workplace at all times; that workers are trained in the use of these devices, including specific software; that there is an adequate back-up system in case of a power outage or emergency; and that the system is part of the overall hazard communication program of the workplace. Also, workers must be able to obtain hard copies of the MSDSs, and, in emergencies, employers must be able to provide copies of the MSDSs to medical personnel immediately.

The directive also states that OSHA will issue citations involving consumer products only when the prod-

uct is used inconsistently with the manufacturer's intentions, or where the frequency or duration of use of the product are "significantly greater" than those of an ordinary consumer. For example, if an employee uses windshield-washer fluid containing methanol on a daily basis to clean windows or other surfaces, that use would be covered by the standard because it differs from the manufacturer's intended use and the frequency and duration differ from normal consumer use.

Citations issued by compliance officers for consumer products or manufactured items must describe the specific hazardous chemical at issue. For example, the citation must specify silica, ketone, or sodium hydroxide, and may not refer simply to "glue" or "detergent."

Other issues covered in the directive include ANSI standards on labeling and MSDS preparation, reiteration of a stay-of-enforcement of the federal requirement that manufacturers update label information within 90 days of receiving information of a significant hazard, and acceptable training procedures.

The directive includes several appendices designed to assist employers in complying with the hazard communication standard. For example, appendices provide guidance on the completeness of MSDSs and provide sample written hazard communications and training programs.

The compliance directive is available on the Internet at <http://www.osha.gov/oshdocs>, under Directives. Paper copies are available through the OSHA publications Office at (202) 219-4667.

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St. Louis and Kansas City Societies' Joint Meeting Slated for June 5-6, in Lake of the Ozarks, MO

The 45th annual meeting of the St. Louis and Kansas City Societies for Coatings Technology is scheduled for June 5-6, 1998, at Lake of the Ozarks, MO.

In recognition of the 45 years of the

two Societies collaborating on educational seminars, the meeting will focus on the theme "Team Missouri."

The meeting will begin with a presentation of both the St. Louis and Kansas City Societies' web sites. The current

and future value to the members will be discussed.

The following topics will also be presented:

"Optimizing Lightfastness of Organic Pigments through Particle Size Control"—Ramesh Kumar, Clariant Corp.;

"History and Development of Epoxy Acid Chemistry"—Delano Eslinger, CCP;

"High Temperature Resistant Coatings"—a speaker from Dow Corning;

"Correlation of Salt-Fog Testing with Electrochemical Evaluation"—James Stoffer, University of Missouri-Rolla;

"Discussion of the Use of Mill Media; In-Line Strainers as Filtration Devices"—Morton Myers, Morton-Myers Co.;

"Product Liability"—David Raymond, Law Firm of Blackwell, Sanders, Matheny, Weary, and Lombardi.

Other activities that have been planned in conjunction with the meeting include a dinner cruise on Lake of the Ozarks and a golf outing.

The registration fee for the meeting is \$95.

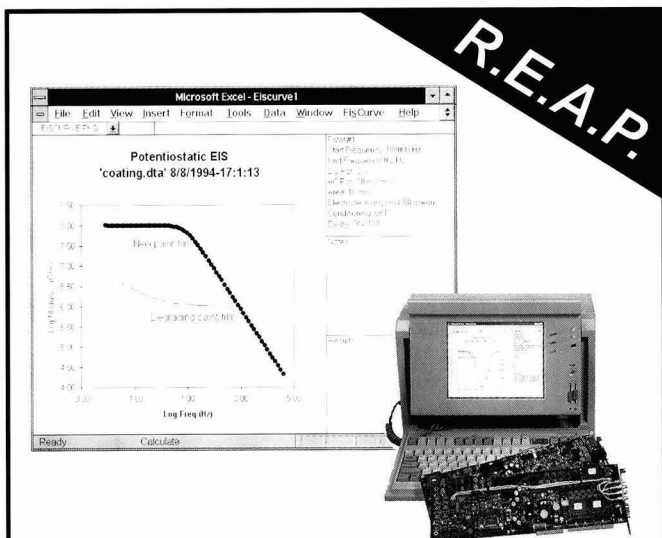
Contact Randy Ehmer, Walsh & Associates, Inc., 500 Railroad Ave., N. Kansas City, MO 64116; (816) 842-3014; FAX: (816) 842-0077, for more information, or visit the Kansas City Society website at www.kcsct.org/lake.htm.

LaQue Corrosion Services Offers Three-Day Course

"Fundamentals of Corrosion and Its Control," a three-day training course, will be conducted by LaQue Corrosion Services, Wrightsville Beach, NC, on September 14-16.

This course is designed to provide important instruction and practical aspects of the process of corrosion and its causes, how to recognize the different forms it takes, how it affects broad classes of metallic materials, and the principal corrosion control methods and corrosion monitoring techniques. In addition, attendees will have the opportunity to view actual corrosion testing and corrosion control methods.

The course fee is \$600. For more information, contact LaQue Corrosion Services, P.O. Box 656, Wrightsville Beach, NC 28480.



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Waterborne Symposium's 25th Anniversary Celebrated During a Ceremony on February 18 in New Orleans, LA

Increasing governmental regulations and changing raw materials supplies and sources are challenges to the coatings industry today. The technology presented at the International Waterborne, High-Solids, and Powder Coatings Symposium on February 18-20, addressed these complexities with the latest research available. Sponsored by The University of Southern Mississippi (USM), Hattiesburg, MS, and held annually at the Hyatt Regency, in New Orleans, LA, this year's symposium attracted 507 attendees from 34 different countries.

The symposium celebrated its 25th Anniversary during a brief ceremony on February 18. The founders of the event Drs. Gary Wildman, George Bufkin, and Shelby Thames were recognized for creating one of the industry's premier technical conferences. In addition, Eve Irvine, President of the Southern Society for Coatings Technology, accepted an award recognizing the Society's support of the Symposium. Also honored during the program for their sponsorship of different events were Eastman Chemical Co., Witco Corp., Bayer Corp., and Troy Chemical Co.

The symposium offered a technical program which featured 44 papers, divided into seven sessions. Three sessions were devoted to waterborne coatings and one each to high-solids and powder coatings. Dr. Rose Ryzntz, of Visteon, set the tone for the symposium with a Plenary Lecture entitled "Coating Evolution in the Automotive Industry." Her presentation was delivered during the Wednesday morning session which was devoted largely to automotive coating technologies.

Dr. Ryzntz's presentation detailed the progression of coatings, from chemistry through mechanical testing requirements

and discussed the future trends in the industry as seen through the eyes of the automotive engineers and scientists.

The symposium concluded with the announcement of the Elias Singer Best Paper Award. This award is presented by Troy Corp. The 1998 recipient was E.C. Galgoci, of Shell Chemical Co., for his paper "New Waterborne Epoxy Systems for Ambient Cure Coatings."

Dr. Galgoci discussed a new waterborne epoxy resin system for ambient cure coatings. These materials offer the potential to develop coating formulations with low volatile organic content (VOC) and nonhazardous air pollutant (HAP) solvents. Dr. Galgoci said that this system is based on a novel solid epoxy resin dispersion cured with a new, amine functional curing agent dispersion.



In addition, the presentation described the new waterborne epoxy resin and amine-functional curing agent system for use in ambient cure coatings on steel or concrete substrates. Dr.

Galgoci's research addressed the influence of amine-to-epoxide stoichiometry on the performance properties of enamel and primer coatings formulated from these new materials.

New to the symposium this year was the Technology Showcase. Seventeen exhibitors participated in this forum for manufacturers, suppliers, and service-oriented providers.

The 1999 Symposium and Technology Showcase is scheduled for February 9-12. For more information, contact Waterborne Coordinator, Dept. of Polymer Science, USM, P.O. Box 10063, Hattiesburg, MS 39406-0063.

Atlas Electric Devices Co. Releases 1998 Schedule for "The Fundamentals of Weathering" Seminar

"The Fundamentals of Weathering," a one-day seminar that emphasizes lightfastness and weathering durability testing techniques, is being conducted by Atlas Electric Devices Co., Chicago, IL. Some of the techniques discussed include natural and accelerated outdoor exposure testing as well as laboratory accelerated methods and instruments.

The seminar will introduce the basics of how various factors of weather and climate, such as solar radiation, heat, and moisture, may affect materials and how to test the resistance of a formulation or product to them. Testing techniques of paints and protective coatings, automo-

tive materials, architectural building products, and molded plastics materials will also be highlighted. Textile and fiber lightfastness and weatherability will be discussed.

The seminar will introduce the fundamentals of natural and accelerated weathering to those involved with designing, evaluating, specifying, selling, or purchasing materials or products that could be affected by exposure to light or weather. This includes materials engineers, product managers, marketing and sales managers, R&D personnel, and formulation chemists.

The seminar will be held in the following cities:

- May 19—San Francisco, CA
- May 21—Seattle, WA
- June 16—Baltimore, MD
- June 18—Montreal, Quebec
- July 14—Dallas, TX
- July 16—Denver, CO
- September 9—Atlanta, GA
- September 11—Detroit, MI
- September 14—Chicago, IL

Tuition for the seminar is \$80.00 per person and includes lunch, refreshments, and course materials.

For more information, contact Peggy Carpenter, Atlas Electric Devices Co., 4114 North Ravenswood Ave., Chicago, IL 60613; (773) 327-4520.

X-Rite, Inc. Offers Color Theory Classes

Color theory classes designed to help professionals develop the tools necessary to manage a color control program are available from X-Rite, Incorporated, Grandville, MI.

Focused on improving participants' understanding of light and color, the classes will teach professionals how to communicate color and use instrumentation to better manage a color control. Topics to be discussed in the course include the techniques and concepts that define color numerically, the various color space tolerances used to manage color differences, commonly accepted

color spaces, and color tolerancing methods.

These classes will benefit anyone who wants to learn about using instrumentation to measure color—from those who have dealt with color visually for years and are interested in implementing a more scientific process, to the professional who is simply curious about color measurement instrumentation.

X-Rite's color theory seminars are offered to the public with an individual registration fee of \$195. For more information, contact X-Rite, Incorporated, 3100 44th St., S.W., Grandville, MI 49418.

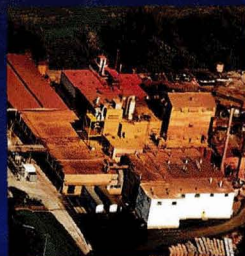
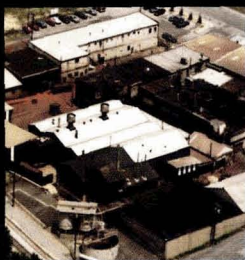
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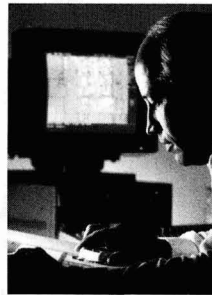
Microstructure of Weathered Paint and Its Relation to Gloss Loss: Computer Simulation and Modeling

Fern Y. Hunt,* Michael A. Galler,[†] and Jonathan W. Martin[†]—National Institute of Standards and Technology

INTRODUCTION

The task of defining gloss is a difficult one, involving a consideration of issues from a number of scientific areas including physics, chemistry, the physiology of vision, and psychophysics. In a consumer product context, we obviously want to isolate the observable and quantifiable characteristics of product appearance associated with high customer appeal. In the coatings industry, particularly the part concerned with automobiles, gloss has traditionally been considered to be such a quantity. J. Braun¹ focused on two factors that define gloss: (1) the intensity of an image, controlled by the refractive index of the surface and angle of illumination, and (2) the distinctness of image (DOI) which is assumed here to be controlled by surface roughness. Most glossmeters measure intensity, but from a human point of view, DOI is the salient characteristic. Indeed, it is well known that human beings are capable of sensing DOI with an accuracy that is several orders of magnitude better than the best available measuring devices (see references [1] and [2]). Despite this, as Braun notes, the two correlate well enough to identify them for the purposes of paint characterization.

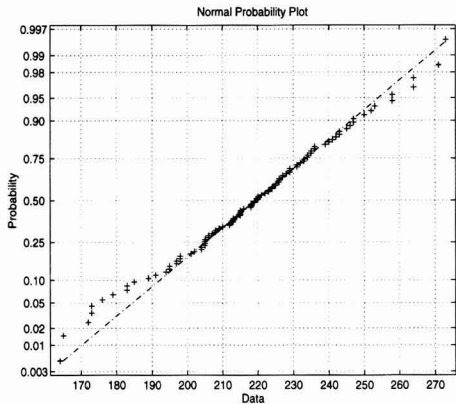
Our purpose here is to investigate the effects of initial coating characteristics on the subsequent gloss loss of a painted surface that erodes during weathering and exposure to ultraviolet light. The theory presented in references [1] and [3] assume gloss loss occurs while the paint film is drying and aging. However, Braun and Cibrachi³ in concede that the end of the aging process is likely to coincide with the beginning of weathering. And it is quite reasonable to assume, we believe, that some surface gloss is still present and is lost as erosion proceeds. In all cases we suppose that the mechanism for gloss loss is surface roughening, so the coating characteristics that we will be most concerned with are those that affect the surface structure of the film and the layers of coating that are exposed in the weathering process. An experimental approach to this problem would involve determining the surface structure of the paint film, measuring the degree of gloss, and then systematically varying the



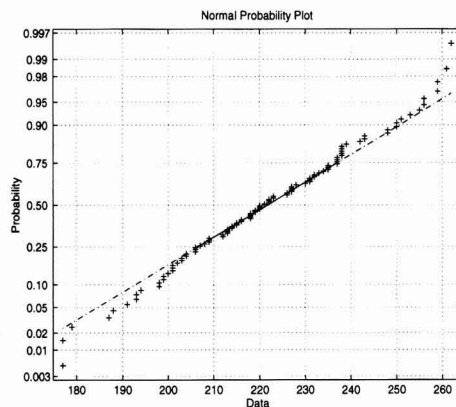
The role of pigment particle size, pigment volume concentration, and dispersion in gloss loss of paint films on weathered surfaces is unclear. Because reproducible and cost effective data are difficult to obtain, an approach based on computer simulation and modeling is a promising supplementary tool. We describe the simulation of a painted surface consisting of pigment particles of known size, pigment volume concentration and dispersion, situated in a binder that erodes over time due to exposure to ultraviolet radiation. Pigment particle size, geometry, pigment volume concentration, and pigment particle dispersion are parameters of the model. Our purpose is to illustrate how simulation can be used to aid the development of formulation strategies for the design of coatings with desirable gloss characteristics.

surface structure by varying the paint composition to identify the relationship between surface structure, paint composition, and gloss loss over time. Experiments of this type are expensive, time consuming, and involve a multiplicity of variables. Here simulation and modeling can play a role. By examining an albeit simplified caricature of the weathering process, we hope to identify relationships between a limited number of coating characteristics and gloss (as measured by surface roughness).

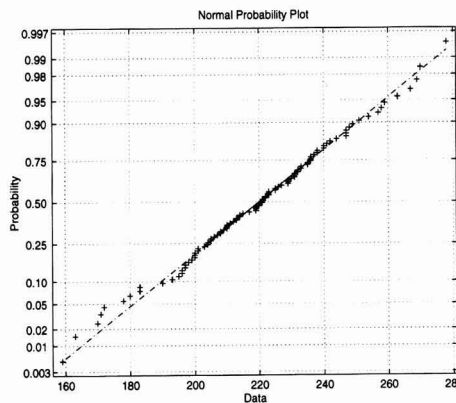
*Mathematical and Computational Science Div., Gaithersburg, MD 20899.
[†]Building Materials Div., Gaithersburg, MD 20899



a Position $x = 0$, Data are heights of profile



b Position $x = 100$, Data are heights of profile



c Position $x = 350$, Data are heights of profile

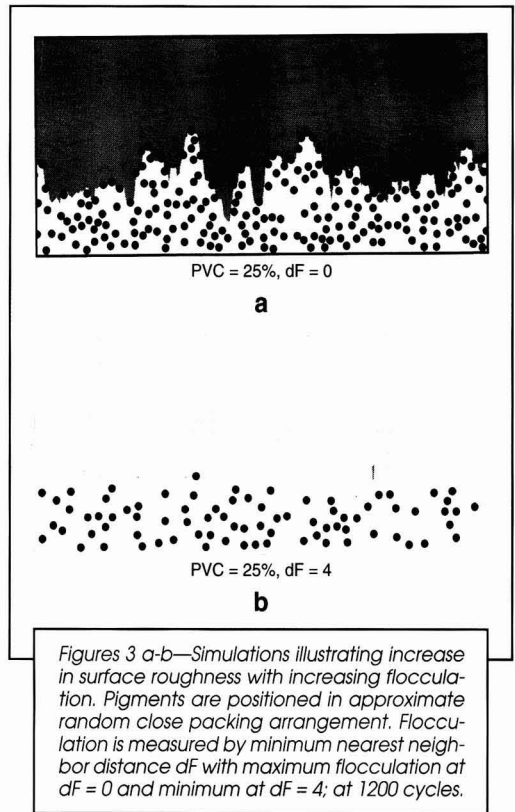
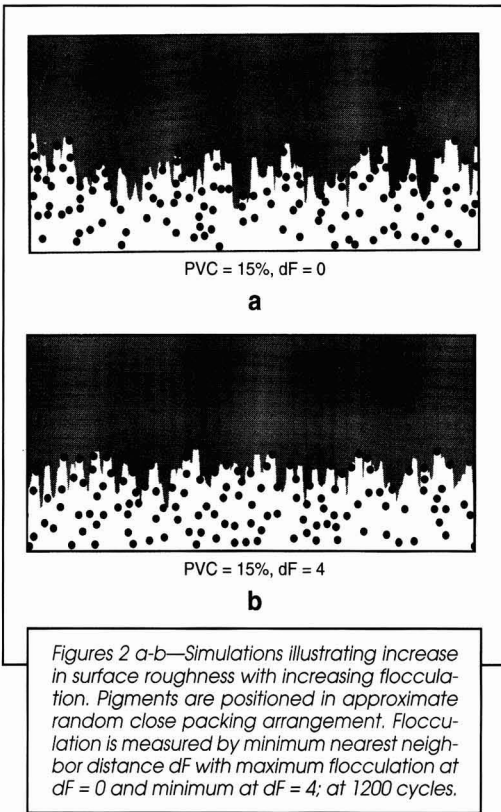
Figures 1 a-c—Normal probability plot of 100 heights at three different positions in the coating, $x = 0, 100$, and 350 . If the data are normally distributed the plot will be linear.

By quantifying these relationships, we hope to organize some of the relevant coating variables that would need to be a part of any experimental effort. Generally, the conclusions of a simulation effort can serve as hypotheses to be tested and the formulation of mathematical models sharpen the experimental design process; helping to distinguish the important variables from the less important.

This paper describes the results of a simulated erosion of a coating consisting of spherically shaped titanium dioxide pigment particles embedded in a polymer binder. For simplicity we follow the changes in a two-dimensional section of the coating calculating the roughness in terms of the standard deviation of the surface heights. The microstructure of the simulated coating is characterized by the pigment particle diameters, pigment volume concentration, and pigment dispersion. The latter is modeled by adjusting the minimum nearest neighbor distance or when studying flocculation, the mean number of pigment particles per cluster. Gloss (as expressed in terms of roughness) is studied over time as a function of the variables determining the microstructure of the unweathered paint film. Our results support the contention that paint films composed of large numbers of small, well dispersed pigment particles retain gloss best. This advantage holds (after an initial transient period) throughout the weathering process.

DESCRIPTION OF SIMULATION

The two-dimensional simulation begins with a 900×400 array of pixels representing a two-dimensional cross-section of a paint film consisting of polymeric binder and pigment particles that are randomly placed in the binder subject to the constraints of a prespecified pigment volume concentration (PVC). At present the pigment particles are either spherically or disk shaped. The latter are used in metallic finishes and vary in size from a diameter of $0.1\text{--}0.3 \mu\text{m}$ for titanium dioxide particles, to $100\text{--}300 \mu\text{m}$ for metallic particles. In the program the diameters of titanium dioxide range from 15 to 43 pixels. Particle dispersion is modeled by varying the minimum nearest neighbor distance between randomly placed pigment particles from the smallest to the largest value consistent with the PVC. Thus at high PVC, the range of possible nearest neighbor distances is limited. The second, and we believe more realistic approach appears to be new to modeling of organic coatings. Pigment particles are distributed according to a Poisson point process (also known as the Neyman distribution) to simulate the "clustering" or flocculation of pigments in poorly dispersed paints. This model is applicable in two-dimensional or three-dimensional simulations. The two parameters of the distribution λ , the mean number of clusters or floccules per unit volume (or area in two-dimensional simulations), and v , the mean number of pigment particles per cluster, can be adjusted to simulate the range of particle dispersions. At the same time, the actual number of pigment particles in any cluster can be randomly assigned; therefore, we can simulate local fluctuations in PVC observed in real coatings. Recently



Fishman et al.⁴ proposed the existence of local fluctuations in the PVC that modify the predicted behavior of coatings at CPVC (critical PVC). In realistic situations these should be expected if only because of variability in the application of the coating. A second advantage of the use of the Poisson process is the ability to obtain a theoretical PVC from the distribution parameters λ and v as will be seen in the Appendix. Thus, pigment dispersion and particle size effects can be examined analytically as well as numerically.

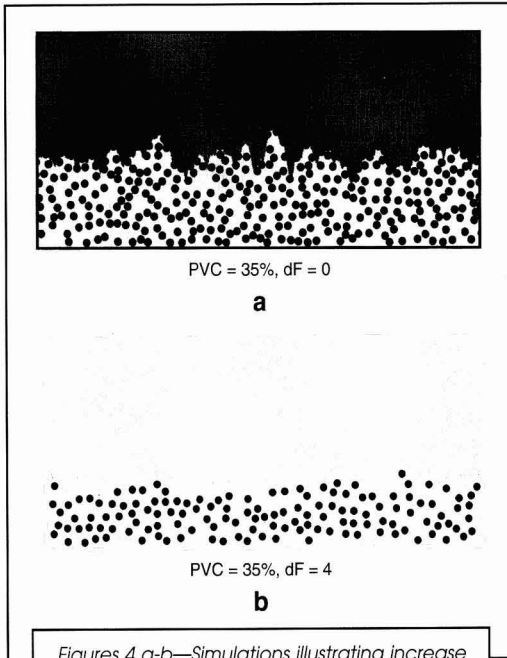
To simulate photolytic degradation, a collimated and uniform "beam" of UV light is projected onto the surface of a paint film penetrating the binder matrix with a strength that decreases exponentially with depth. As the beam proceeds downward, it damages the binder matrix directly by adsorption by binder or indirectly as light radiation is reflected off pigment particles and then is absorbed. It is assumed that the damage from the reflected light is uniform over the entire surface and includes binder located in areas that are shielded from direct radiation. Initially pigment particles shield the binder below them. This eventually leads to the formation of "pedestals" that support single pigment particles as seen in the SEM micrographs in Kampf et al.⁶ (see Figure 5a for comparison). Eventually, indirect and reflected radiation erodes the pedestals and the now loosened pigment particles are removed from the simulation. In real coatings this process is called chalking. The

damage around a pigment particle is calculated in the following way:

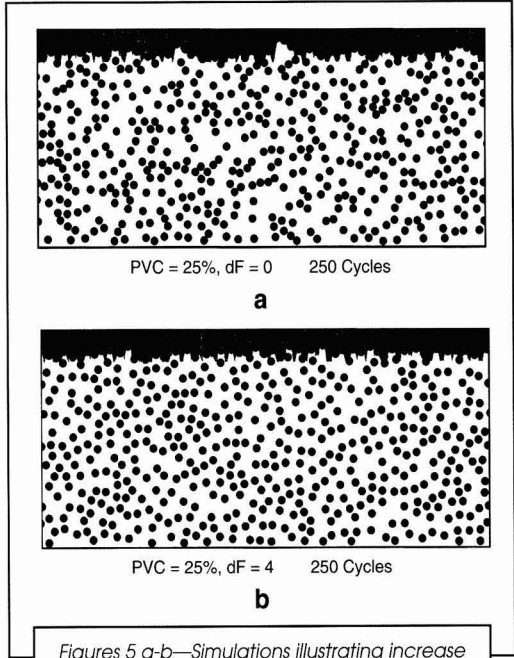
- (1) When a collimated UV beam hits a pigment particle, a portion of the power of the beam is recorded. The portion, called the light strength, is determined by a pre-selected damage parameter. The sum of the light strengths is calculated for each sweep of the UV beam across the matrix.
- (2) At the end of each sweep, the number of binder pixels which have at least one edge exposed to the air is calculated. This is the area to which the reflected damage will be applied.
- (3) The amount of damage applied to each pixel in this area is calculated by taking the sum from step 1 and dividing it by the total number of pixels calculated in step 2.
- (4) The damage is applied by taking the damage per pixel sum calculated in step 3 and subtracting it from the strength value of each pixel counted in step 2.

Binder pixels whose pixel strength fall below a threshold are then removed by being converted to air pixels.

Chalking can also be caused by anatase or unstabilized rutile titanium dioxide pigments. These pigments damage portions of the binder at the pigment-matrix interface by creating hydroxyl and peroxy radicals when the pigments are hit by UV photons. Figure 15 shows a closeup of the pigment particles and binder in such a



Figures 4 a-b—Simulations illustrating increase in surface roughness with increasing flocculation. Pigments are positioned in approximate random close packing arrangement. Flocculation is measured by minimum nearest neighbor distance dF with maximum flocculation at dF = 0 and minimum at dF = 4; at 1200 cycles.



Figures 5 a-b—Simulations illustrating increase in surface roughness with increasing flocculation. Pigments are positioned in approximate random close packing arrangement. Flocculation is measured by minimum nearest neighbor distance dF with maximum flocculation at dF = 0 and minimum at dF = 4; at 250 cycles.

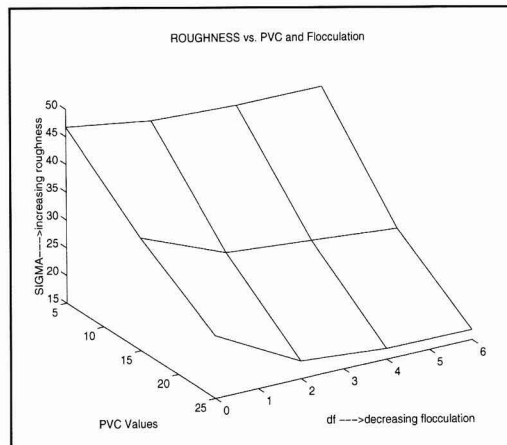


Figure 6—Surface roughness is plotted as a function of PVC and degree of flocculation (dF). Higher dF value means less flocculation. Simulation after 1200 cycles.

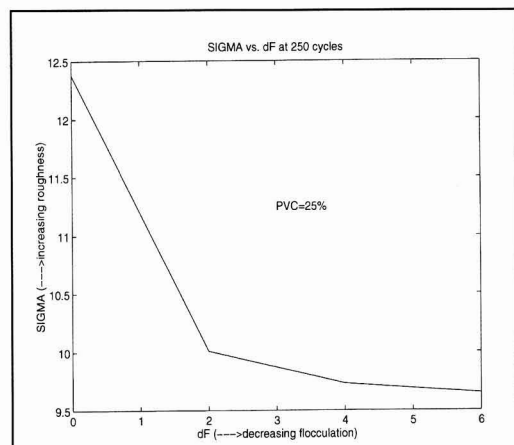


Figure 7—Surface roughness (Sigma) plotted as a function of flocculation. Higher dF values indicate less flocculation. Simulation after 250 cycles.

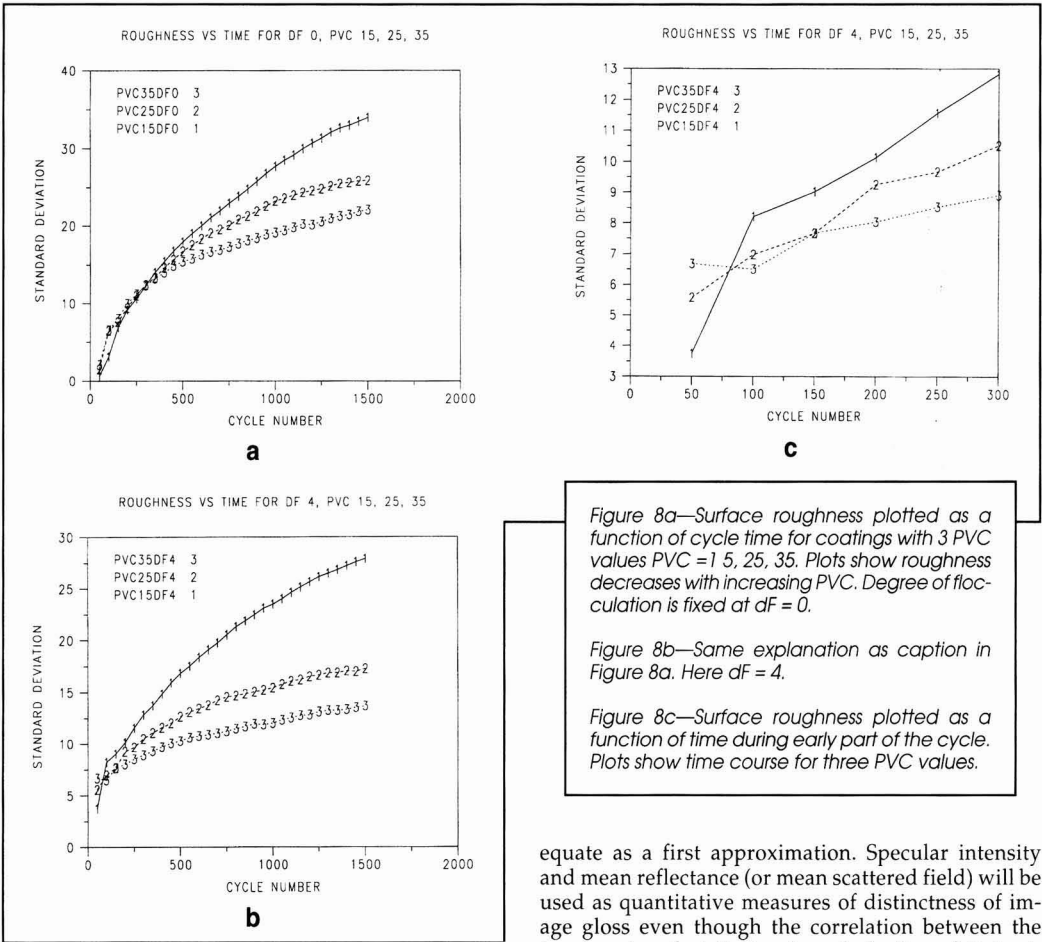


Figure 8a—Surface roughness plotted as a function of cycle time for coatings with 3 PVC values PVC = 1 5, 25, 35. Plots show roughness decreases with increasing PVC. Degree of flocculation is fixed at df = 0.

Figure 8b—Same explanation as caption in Figure 8a. Here df = 4.

Figure 8c—Surface roughness plotted as a function of time during early part of the cycle. Plots show time course for three PVC values.

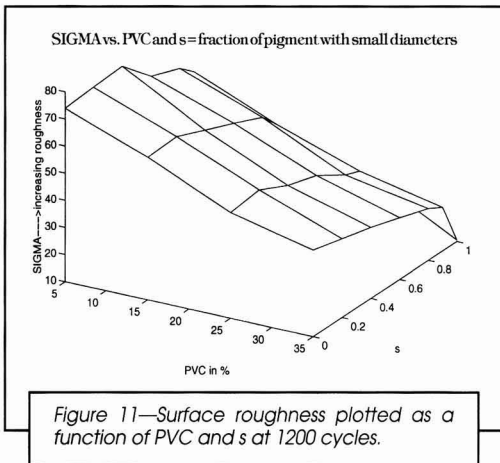
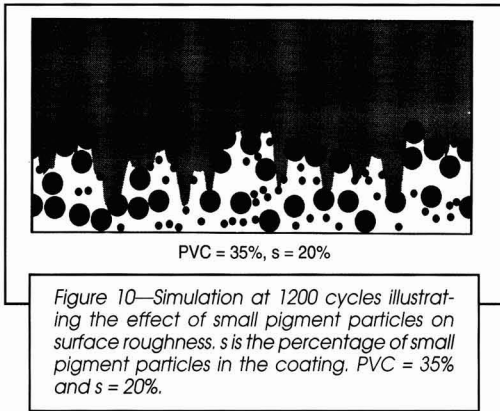
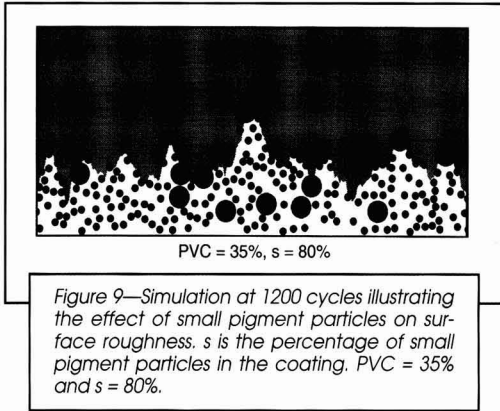
simulation. Such photolytically active pigments can be modeled and the resulting weathered surface and its gloss properties characterized. In this way the strategy of inserting a certain fraction of photolytically active pigment particles to enhance gloss can be explored.

MODELING AND ANALYSIS OF GLOSS IN PHOTODEGRADED SURFACES

Distinctness of image is largely affected by surface roughness so that a reasonable study of gloss can be undertaken by studying the texture of a randomly generated irregular surface. We begin with the physical optics theory as summarized by Beckmann and Spizzichino⁷ that, at least in principle, predicts the angular distribution of light flux reflected off a rough surface as a function of the angle and wavelength of the incident light. This theory has limitations however. For example, it cannot account for masking and shadowing effects, and it assumes the surface is a perfect conductor. Nevertheless, it is the foundation for more sophisticated scattering theories and is ad-

equated as a first approximation. Specular intensity and mean reflectance (or mean scattered field) will be used as quantitative measures of distinctness of image gloss even though the correlation between the two is not perfect. Better characterization of distinctness of image is a complex problem that involves human psychophysics and for this reason is beyond the scope of the model discussed here. However, we are working on the use of computer graphic renderings of surfaces based on good physical models of reflectance and this approach should be useful in dealing with some of these difficulties. A recent discussion of these and other issues surrounding the measurement and modelling of coating appearance can be found in reference [8].

Weathering is a random process so the resulting roughened surface may be considered to be random. Following Beckmann, we will assume the surface profile can be described by $z = \zeta(x)$ where x is the horizontal coordinate, $-L \leq x \leq L$, and z is the vertical height coordinate. ζ is assumed to be a random normally distributed variable that is independent of the second horizontal coordinate y ; however, this assumption can be dropped with suitable modifications to the formulas. If the mean or expected value of ζ is μ and the standard deviation is σ , then these quantities can be estimated from the surface heights of the simulation as follows: letting N be the number of surface heights used in the calculation, the mean profile height is given by



$$\mu = \sum_{k=1}^N z_k / N \tag{1}$$

where $\{z_k\}$ are the surface heights and the standard deviation is given by

$$\sigma = \text{SQRT} \left(\frac{1}{N} \sum_{k=1}^N (z_k - \mu)^2 \right) \tag{2}$$

Aside from σ another crucial quantity in determining gloss is the correlation length T . This quantity is determined by the Gaussian random process (x, y, ζ) and can be estimated from the profile heights as follows: first,

$$C(j) = \frac{1}{\sigma^2(N-j)} \sum_{k=1}^{N-j} z_k z_{k+j} \tag{3}$$

where $j = 1, \dots, N-1$ is a variable representing the spatial delay. Equation (3), is used to estimate the correlation function $C(\tau)$ for $\tau \geq 0$. T , the value for which $C(\tau) = e^{-1}$, is found by interpolation.

The human eye cannot detect polarization, so in our application we may, with Beckmann, neglect it and concentrate on the scalar component of the scattered light. Define $\rho(\theta)$ to be the ratio of the field scattered in the direction θ to the field scattered in the direction θ_{inc} . Angles are measured with respect to the direction normal to the x - y plane. ρ is a random number since the reflecting surface is random; hence the mean scattered field $E(\rho(\theta))$ and $I(\theta)$ the mean power of light scattered in the direction θ are used to quantify reflectance. I , also called the intensity is,

$$I(\theta) = E\{\rho(\theta)^2\} \tag{4}$$

Gloss or specular reflection is measured by $I(\theta)$ and $E(\rho(\theta)_{spec})$ when $\theta = \theta_{inc}$. The latter expression is,

$$E(\rho(\theta)_{spec}) = \exp \left(-1/2 \left(\frac{4\pi\sigma \cos(\theta)}{\Psi} \right)^2 \right) \tag{5}$$

where Ψ is the wavelength of the incident light. $I(\theta)$, can be expressed in terms of σ and T . Using the assumption $T \gg \Psi$, Beckmann's analysis shows that

$$I(\theta) \approx \begin{cases} \frac{2\pi^{5/2} \sigma^2 T [1 + \cos(2\theta)]^2}{\Psi^{2L}} & \text{if } g \ll 1 \\ \frac{\Psi(T/\sigma)}{\sqrt{(\pi)L \cos(\theta)}} & \text{if } g \gg 1 \end{cases} \tag{6}$$

and if $g \approx 1$,

$$\frac{\sqrt{(\pi)F^2 T g}}{2L} \exp(-g) \leq I(\theta) \leq \frac{\sqrt{(\pi)F^2 T}}{2L} \tag{7}$$

where $F = \sec(\theta_{inc})^2$ and $g = g(\theta, \theta_{inc}) = [2\pi(\cos(\theta_{inc}) + \cos(\theta))]^2 (\sigma/\Psi)^2$.

Experimental evidence for the relationship between roughness and gloss as we have defined it here can be

found in the work of Lettieri et al.⁹ in their study of light scattering from glossy coatings on paper. Using an array of laser light detectors, they measured the spectral reflectance (light scattering patterns) for a full range of incident angles and a sample of glossy papers with different degrees of roughness. The data clearly showed that the intensity of gloss increased as the roughness as measured by the standard deviation decreased (see Figure 9 in reference (9)). Surface heights of the paper samples were measured using mechanical stylus profilometry and values of the standard deviation and correlation length were calculated. Using a power law model for the correlation the authors were able to predict the light scattering pattern by using Beckmann's formula. The results compared favorably with light scattering measurements.

RESULTS OF SIMULATION

The heights of the peaks in the weathered profile after any cycle time are assumed to be normally distributed. Evidence supporting this is depicted in Figures 1a-c which show the normal probability plots at fixed values of x. Each graph was computed from 100 heights corresponding to 100 different runs of the weathering process after 1200 time cycles or midway through the weathering cycle. The heights were ordered from small to large.

If the simulation heights are normally distributed, a plot should lie scattered along a straight line. Normal probability plots of x located at various horizontal positions in the profile show that agreement is reasonable. That is, the assumption that the heights are normally distributed appears to be justified.

Using formulas 1 and 2 from the previous section, the mean μ , the standard deviation or roughness σ , and the correlation length T, were computed from a simulated weathered surface after 250 and 1200 cycle time steps, for several pigment sizes s and dispersion values dF. The flocculation parameter dF is the minimum distance of two pigment particles, hence it controls the degree of dispersion. The parameter dF was obtained by placing pigments in the initial coating randomly in close approximation to random close packing. Pigment particles were placed at a distance greater than or equal to a minimum set by the parameter dF. If dF=0, the pigment particles can be at arbitrarily small distances from each other (actually they are allowed to touch) producing a pigment distribution with the maximum degree of flocculation. The larger the value of dF, the greater the minimum and the larger the amount of pigment dispersion. This is consistent with the observations of paint technologists.¹

Our results qualitatively support Steig's¹⁰ observations that the rate of gloss loss of coatings depends on the particle size distribution and dispersion of the pigment particles. In particular, as the surface erodes revealing the underlying structure, flocculation or the presence of large pigment particle clusters can lead to rapid gloss loss while coatings with many small uniformly distributed particles retain their gloss, even in the presence of many dry particles. Our simulation provided a

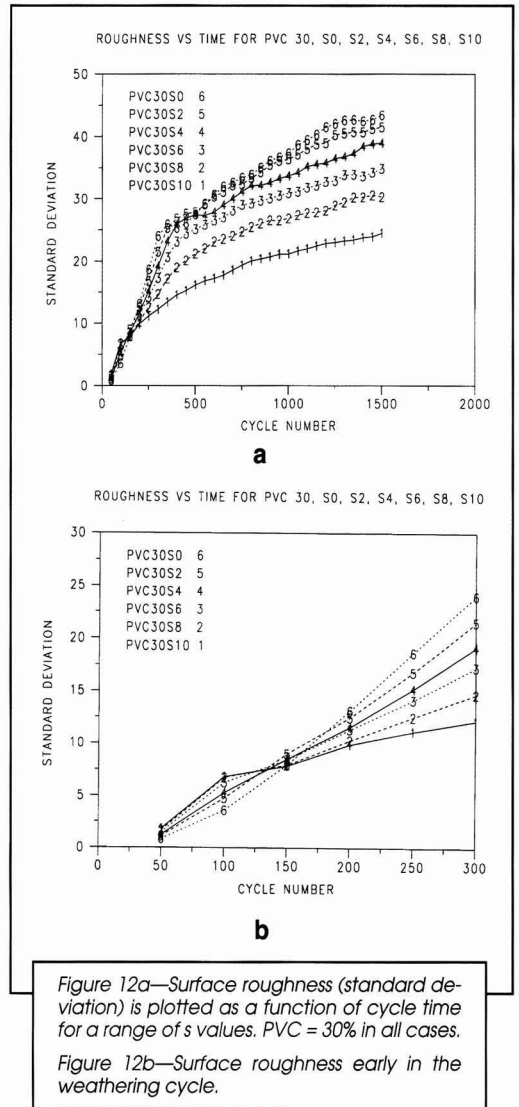
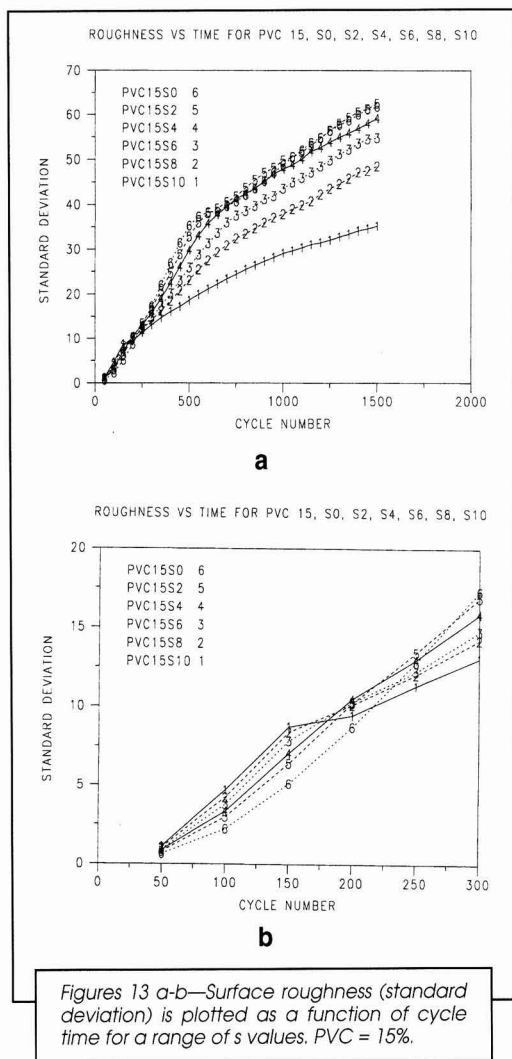


Figure 12a—Surface roughness (standard deviation) is plotted as a function of cycle time for a range of s values. PVC = 30% in all cases.
 Figure 12b—Surface roughness early in the weathering cycle.

qualitative demonstration of these observations and illustrated the effects of pigment size and flocculation separately. As formulas 5 and 6 show, gloss is essentially controlled by surface roughness σ , so we focus on the dependence of this variable on pigment particle size and degree of flocculation.

Figures 2 a-b to 5 a-b illustrate the relationship between surface roughness, pigment volume concentration, and flocculation. For each pair of figures, the original microstructure consisted of a coating having the same PVC (pigment volume concentration) but different degrees of flocculation. As can be seen in each case, the rougher weathered surface came from the surface with the higher degree of flocculation (or equivalently lower dF values). The comparisons were made at 1200 cycles for PVC = 15, 25, and 35% with dF = 0 and 4, and at 250



cycles for PVC = 25%, dF = 0 and 4. After an initial period of about 250 cycle times, we see that roughness of the weathered surface decreases as the PVC of the unweathered surface increases. Figures 6 to 8c confirm this observation for a range of PVC and dF values. Braun¹ confirms the experimental validity of these conclusions. He found that an increase in PVC leads to a decrease in gloss until the CPVC is reached.

To investigate the effect of pigment particle size, we simulated the photodegradation of coatings with a distribution of large and small pigments where the pigment size ratio of the two types in diameters was 3 to 1. The percentage of small pigment particles in the initial coating was *s*. After weathering, surfaces with different values of *s* were compared and as depicted in Figures 9 and 10, the simulation results imply that coatings containing larger fractions of small particles are smoother. Calculations for these figures were carried out at 1200

cycles. Figure 11 shows roughness plotted as a function of PVC and *s*, at 1200 cycles. This phenomenon was investigated in somewhat more detail in Figures 12 a-b and 13 a-b. After an initial transition period, they show that through most of the weathering cycle, roughness decreases as the percentage of small pigment particles increases. Figures 12 a-b are at PVC = 30% while Figures 13 a-b are at PVC = 15%. Figure 11 illustrates this point for a range of values of PVC and *s*. It is interesting to note that these simulation results are also consistent with a recent study by Braun and Fields⁵ on the gloss performance of unweathered water-based and solvent-based titanium dioxide paints. Comparing coatings with different size distributions of pigment particles they found a direct correlation between the percentage of large pigment particles (coarse tail of particle size distribution) and 60° gloss. Thus, despite the obvious complexity of the UV degradation process, the simulation suggests that this relationship will continue throughout the weathering process.

CONCLUSION

To better understand the link between formulation and gloss retention of painted surfaces subject to UV degradation, we developed a computer simulation that captures some of the physical aspects of film and surface appearance changes during the weathering process. Pigment particle size and particle dispersion are parameters that can be controlled in the simulation. Pigments were randomly placed in an approximation of random close packing. To model flocculated and poorly dispersed paints, we used a Poisson point process (see Appendix). Our results showed that after an initial transient period, surfaces with a high PVC had a higher degree of gloss (as measured by roughness) than those with low PVC. Similarly, after some initial transient, we observed the highest gloss of surfaces with the largest numbers of small pigment particles. These results were valid through a range of PVC values and are consistent with earlier experimental and theoretical work by Steig and later by Braun and others.

ACKNOWLEDGMENT

It is a pleasure to thank Dr. Juergen Braun (retired), Dr. Karlis Adamsons, and Dr. Paul Tannenbaum, all of E.I. DuPont de Nemours & Co., and Dr. Mary McKnight and Dr. Tinh Nguyen of NIST for their advice and helpful discussions.

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Appendix

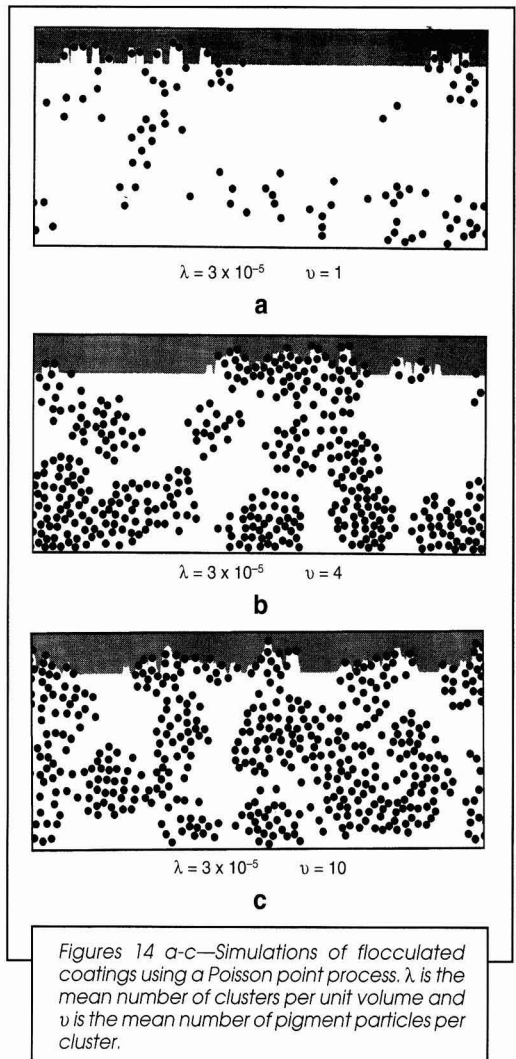
In this section we discuss the results of using a so-called Neyman-Scott point process to determine the placement of pigment particles. We propose this distribution as a model of clustering of flocculation. N random uniformly distributed points (x_i, y_i) , $i = 1, \dots, N$ are selected to be the centers of N flocculates of pigment particles. Within the i th cluster, we next select M points uniformly distributed in a circle with center (x_i, y_i) and radius R . The numbers N and M are discrete Poisson random variables with mean values μ and ν respectively. Thus the parameters controlling pigment placement in this scheme are μ , ν , and R . Note that for a fixed volume V , the number μ may be expressed in terms of an intensity parameter λ as $\mu = \lambda V$. Figures 14 a-c shows the results of calculating σ for a weathered surface with an initial pigment distribution with parameters $\lambda = 3 \times 10^{-5}$ and $\nu = 1, 4, 10$ at cycle time 250. In each run all pigments had the same diameter.

Simplified estimates of the pigment volume concentration and degree of flocculation can be obtained in terms of the parameters of the process, thus allowing the introduction of some precision in the discussion of these variables. The following expression, called the theoretical PVC or TPVC, makes use of the fact that $\mu\nu S$, where S is the volume of a single pigment particle, is an estimate of the total volume of pigment in the coating. If V is the total volume of the coating,

$$\text{TPVC} = (\mu\nu S)/V \quad (8)$$

For convenience, we will confine our subsequent discussion to two dimensions, that is, to area measurements. Let Ω be a planar region with area $A(\Omega)$. The expected number of pigment particles in Ω , that is the mean value of the random number $n(\Omega)$, can be written as $E(n(\Omega)) = \nu\lambda A(\Omega) = \nu\mu$ (reference [11]). The degree of flocculation can be expressed in terms of the fluctuation in the number of pigment particles as one samples different regions Ω . Using the fact that the Neyman-Scott distribution is a homogeneous Poisson point process, we can express this fluctuation in terms of the variance of $n(\Omega)$ ¹¹

$$\text{var}[n(\Omega)] = 2\pi\rho^2 G_1 + \rho V G_2 + \rho A(\Omega) - (\rho A(\Omega))^2 \quad (9)$$



Figures 14 a-c—Simulations of flocculated coatings using a Poisson point process. λ is the mean number of clusters per unit volume and ν is the mean number of pigment particles per cluster.

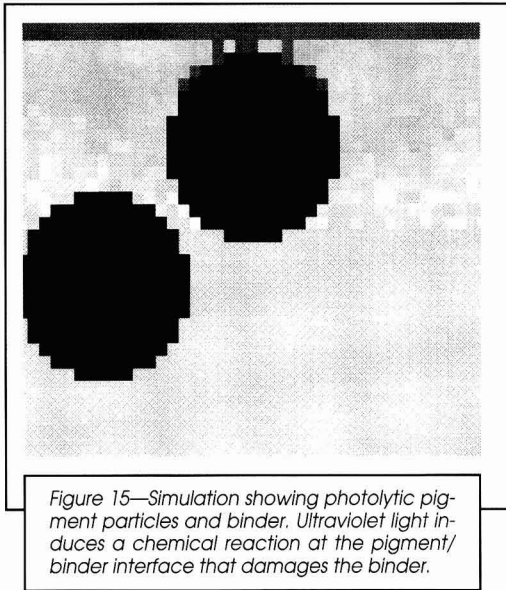


Figure 15—Simulation showing photolytic pigment particles and binder. Ultraviolet light induces a chemical reaction at the pigment/binder interface that damages the binder.

where $p = \lambda v$, G_1 is a geometric constant depending on the area and shape of Ω , and G_2 is another geometric constant that depends only on R which we assume is fixed. These constants are known for simple geometric shapes Ω . Let us suppose that λ and v can vary in such a way that their product p is fixed. If p is fixed, it follows from equation (8) that the TPVC is fixed since $\mu = \lambda A(\Omega)$, and

$$TPVC = \lambda v S = pS$$

Here S is the area of a single pigment particle. Equation (9) shows that the variability of $n(\Omega)$ can be increased by increasing the average cluster size v and keeping p fixed. Thus we have a theoretical description of how control of flocculation can be achieved by controlling the cluster size and number of clusters without changing the PVC—precisely the effect of adding surfactants to a coating formulation. Indeed Figures 16 and 17 show two realizations of a Poisson process with $\mu = 10$, $v = 30$ and $\mu = 30$, $v = 10$, respectively. Although realizations were selected so that the TPVC is the same and the PVC differs by no more than 0.1%, the pigments in Figure 17 appear to be better dispersed than those in Figure 16.

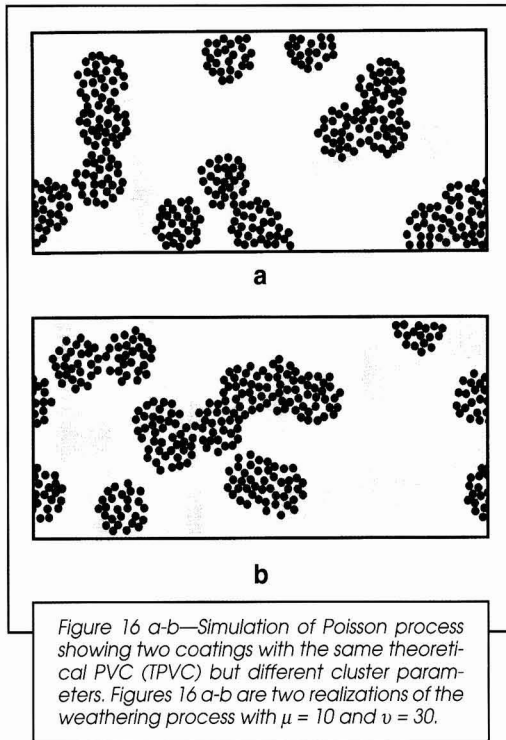


Figure 16 a-b—Simulation of Poisson process showing two coatings with the same theoretical PVC (TPVC) but different cluster parameters. Figures 16 a-b are two realizations of the weathering process with $\mu = 10$ and $v = 30$.

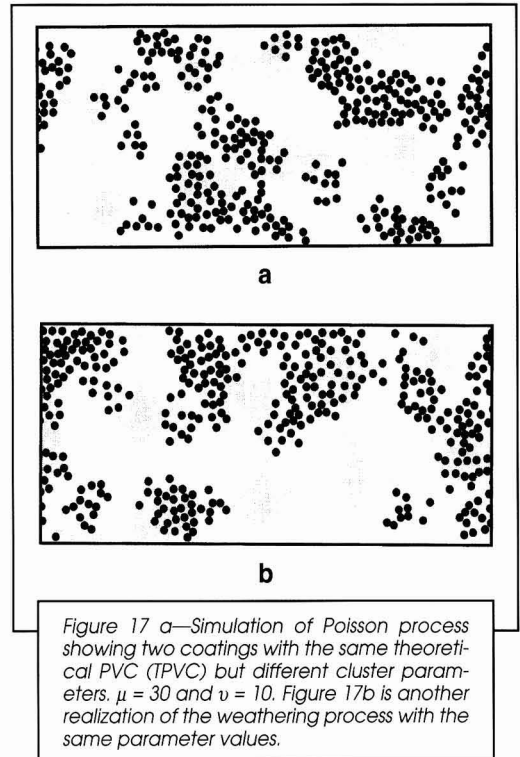


Figure 17 a—Simulation of Poisson process showing two coatings with the same theoretical PVC (TPVC) but different cluster parameters. $\mu = 30$ and $v = 10$. Figure 17b is another realization of the weathering process with the same parameter values.

A New Approach in the Development and Testing of Antifouling Paints Without Organotin Derivatives

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P. Guerin and V. Langlois—Laboratoire de Physico-Chimie des Biopolymères
J.Y. Langlois—NAUTIX

INTRODUCTION

Fouling and corrosion are both major issues in the protection of ship hulls. The growth of plants and mollusks, which settle on immersed surfaces, results in a considerable increase of friction resistance affecting speed and fuel bills.¹⁻⁶ Generally, fouling development is prevented by means of antifouling paints containing one or more toxic compounds like organotin derivatives. However, in the early 1990s, environmental concerns resulted in a progressive withdrawal of organotin biocides. The established and projected restrictions have created a major problem for the shipping industry.⁷⁻³⁰ Many research programs are trying to find an alternative to organotin biocides.³¹⁻³⁶ Resanbio[®], a cooperative research program, plans to develop biodegradable antifouling paints.

To develop new antifouling paints, it is very important to test and to quantify the efficiency of the new materials. However, all the methods used are characterized by a lack of precision in the study of the binder evolution and in the assessment of paint performances.³⁷⁻⁴⁴ A better understanding of phenomena involved in antifouling activity needs an analytical protocol. Available literature about assessment and control of antifouling coatings efficiency is poor. Different and complementary analytical methods in the goal to reveal chemical reactions that occur during erosion and antifouling action are presented. The processes used are explained and illustrated by an example of an efficient, erodable, antifouling paint.

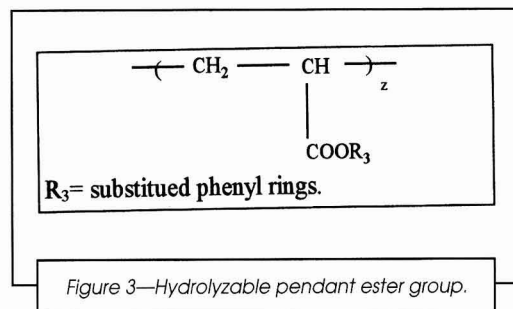
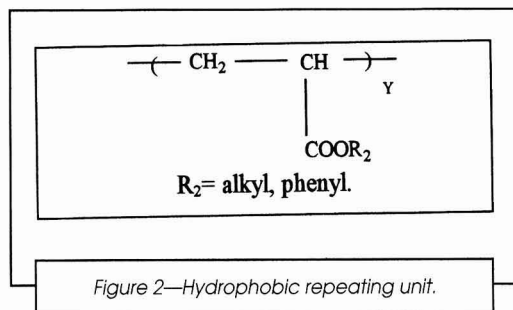
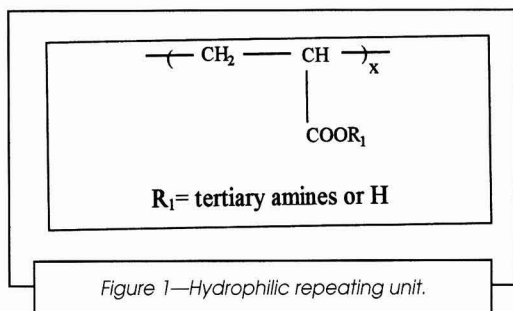
CHOICE AND CHARACTERIZATION OF THE CHEMICAL STRUCTURES

The binders studied were acrylic copolymers with pendant hydrolyzable functions and a variable hydrophobic/hydrophilic balance.⁴⁵

Hydrophilic repeating units were introduced in order to make water penetration in the film easier. Indeed,

Environmental concerns have led to a progressive withdrawal of antifouling paints containing organotin derivatives. Resanbio[®], a cooperative research program, plans to develop new antifouling paints that are more compatible with living species. In the first stage, we studied specific acrylic polymers with a variable hydrophilic/hydrophobic balance and, in some cases, pendant hydrolyzable functions. To evaluate the ability of these materials for hydrolysis, biocides release, and erosion, test panels with formulated films were prepared and immersed in sea water. An analytical protocol was established to characterize the polymeric material, to reveal chemical reactions that occur during erosion and antifouling action, and to understand the influence of the resin chemical structure on the paint's antifouling efficiency. The degradation of these binders was revealed by the appearance of a product resulting from the hydrolysis. This product was identified and quantified by GC-MS. The release of cuprous oxide as model molecule, due to its water solubility and biocide activity, was quantified by inductively coupled plasma. The different processes used are explained and illustrated by an example of an efficient, erodable, antifouling paint following 22 months of immersion.

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water penetration is essential to biocides release and erosion phenomenon. A hydrophilic repeating unit was used (e.g., methacrylic acid).

Hydrophobic units were introduced in order to obtain the solubility as xylene or naphtha and to control water penetration in the film. Hydrophobic units, such as butyl acrylate, was used to enhance the mechanical properties of the paint film.

Hydrolyzable functions lead to a progressive degradation of the immersed binder and to the initiation and the control of erosion. The product R₃-OH results from the hydrolysis of the pendant ester group. Benzoxymethyl methacrylate was used as hydrolyzable functions. In this case, the product resulting from hydrolysis was benzoic acid.

The binder A was a terpolymer containing three kinds of units: 50% (molar) of hydrolyzable monomer, 10% (molar) of hydrophobic units, and 40% (molar) of hydrophilic units. The binder B was a copolymer containing

hydrophilic (30% molar) and hydrophobic (70% molar) units. These polymers have been obtained by radical polymerization carried out in solution and/or in bulk at 70°C. Their compositions were determined by FTIR and ¹H NMR spectroscopies. Thermal properties (glass transition temperature and starting degradation temperature) were estimated by differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). In order to better characterize the copolymers, molar weights (size exclusion chromatography (SEC), osmometry, viscosimetry and scattering light) and the reactivity ratios of co-monomers (Kelen-Tüdös method) were also determined.

PERFECTING THE ANALYTICAL PROTOCOL

Figure 4 explains the organization of the evaluation protocol of paints. Three main parts can be distinguished: choice of the coatings, choice of the substrates, and choice of the analytical methods used to study the binders and the corresponding paints during immersion.

Choice of the Coatings

The study of marine paints is very difficult because their formulations contain a large number of components. Each one is important in regard to the final performance of paints. Three kinds of coatings were prepared and studied.

The first coating consisted of a varnish containing the polymeric binder in solution in xylene or naphtha (50% weight).

In the second coating, the polymer in solution was mixed with one component of the formulation: copper oxide, titanium dioxide, other pigments or biocides.

The third coating is the formulated paint with all fillers and additives. Particular care was taken during blend homogenization and pigment dispersion. The chosen formulation, Resanbio, contains the different biocides and additives which are commonly used in the antifouling paint industry.

Fineness of grind, hiding power, and filmogen properties of the different paints were controlled.

Choice of the Substrates

The selection of vinyl ester composite panels was justified by a double need. We wanted to obtain accurate information about phenomena involved in the erosion; it is necessary to quantify the different products resulting from the binder degradation without corrosion or erosion of the substrate. Vinyl ester resins are known to have an excellent hydrolysis and solvent resistance. The second requirement was that the testing conditions must be as close as possible to the actual conditions of use. For these reasons some test panels were covered by polyester gel-coat before application of the paints.

Painted panels were immersed in synthetic sea water and in natural sea water in order to compare the results obtained in each case. Tests realized in synthetic sea

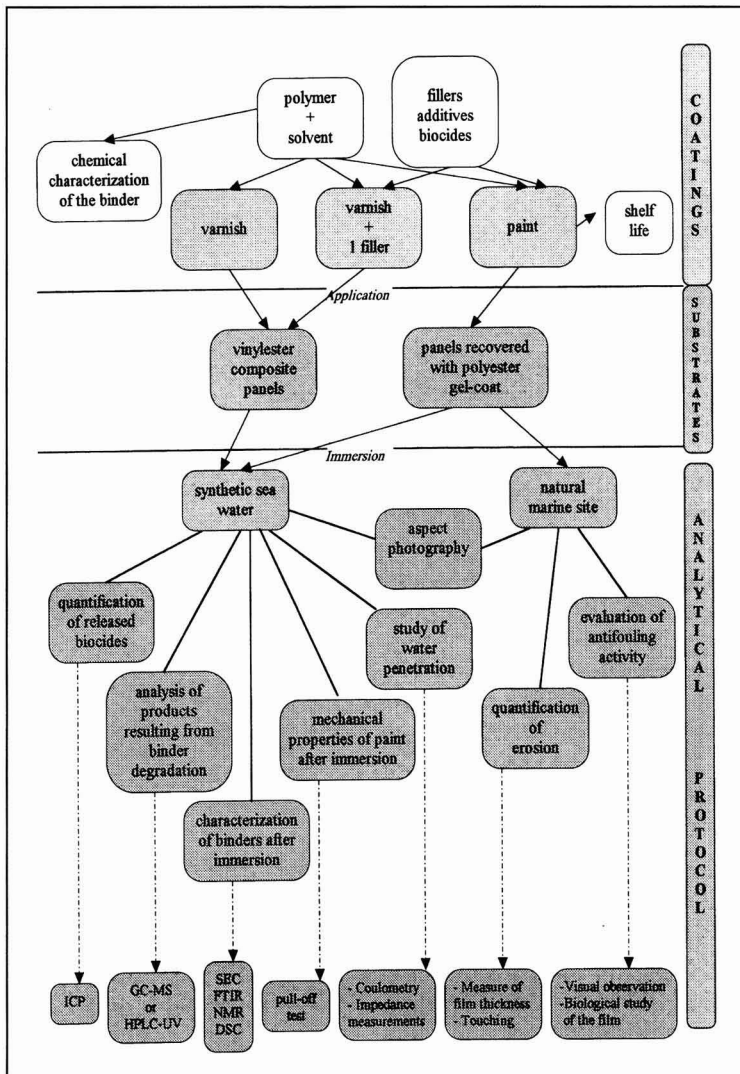


Figure 4—Analytical protocol used.

WATER PENETRATION: Water penetration is essential to obtain erosion and antifouling action. The study of water uptake of varnish or paint films is difficult. Two complementary techniques have been used. Coulometry measures the whole water amount present in the film. Electrochemical impedance measurements give information about water amount absorbed and the ease and depth of the penetration.

BINDER HYDROLYSIS: All of the studied polymeric binders possess one or more hydrolyzable functions. The hydrolysis was controlled by the analysis of water: products resulting from hydrolysis were identified and quantified by gas chromatography (GC)-mass spectrometry (MS) or high performance liquid chromatography (HPLC)-UV following product polarity. The chemical characteristics of the aged polymers were estimated by FTIR, ^1H NMR, DSC, and SEC.

COPPER AND ZINC RELEASES: The titrations of copper and zinc were made simultaneously by inductively coupled plasma (ICP). The cuprous oxide was chosen as the model molecule due to its water solubility and biocide activity.

water make a precise and reproducible study of the binder and the corresponding paints during immersion possible. The composition of the synthetic sea water is presented in Table 1.

Tests realized in natural sea water make a comparison between natural and synthetic waters possible: they provide a validation of the laboratory tests.

Analytical Protocol

During immersion, the film degradation leads to the evolution of many characteristics that have been studied simultaneously:

FILM ASPECTS: Simple visual observation can give information about the varnishes and paints evolution. We noticed the loss of gloss and the development of faults, such as blistering or loss of adhesion.

MECHANICAL PROPERTIES OF PAINTS: The films were studied by the pull-off test (standard NFT 30-062: Paints - Determination of the tear-off strength, AFNOR 1981).

EROSION: Erosion was estimated by two techniques. The "touching method" is widespread. An organostannous paint is used as reference. This evaluation of erosion greatly depends on the examiner's experience. The second method to evaluate erosion consists in measuring the paint thickness decrease by magnetic standard procedure (standard NFT 30-124: Paints-Determination of dry film thickness. Nondestructive instrumental methods, AFNOR 1979). In order to use this standard, specific substrates with a metallic core were made.

ANTIFOULING ACTION: Antifouling action has been evaluated by a simple visual check of test panels and by microscopic and biological study of the bacteria present on the paint surface after five days of immersion. The

Table 1—Composition of the Synthetic Sea Water

Water	20 kg
NaCl	600 g
H ₃ BO ₃	25 g
Na ₂ HPO ₄	3.8 g
Na ₂ CO ₃ saturated	20 g

Table 2—Study of the Hydrolysis of the Resin A by ¹H NMR

Time (days)	Ratio I/i
0	0.149
8	0.143
13	0.126
17	0.100

Table 3—Characteristics of Fillers

Filler	Characteristic
Cuprous oxide	Hydrophobic
Modified cuprous oxide	Hydrophobic
Titanium oxide	Hydrophilic
Zinc oxide	Hydrophobic
Biocide 1	Hydrophilic
Biocide 2	Hydrophilic
TBT	Hydrophilic

reference paint used was Biomet: an organostannous paint which assembles all the desired properties (erosion and antifouling activity). The Lorient harbor (in France), which is a favorite place for the growth of fouling, was the test site. The antifouling action of the paints was evaluated during spring and summer.

This protocol was justified by the corroboration of the results obtained in vitro and in natural site. It is illustrated by an example of the study of new binders for erodable antifouling paint without organotin derivatives. These binders, noted A and B, were presented previously.

EVALUATION OF TWO NEW BINDERS WITHOUT ORGANOTIN DERIVATIVES

Water Absorption

Panels with varnish of the two polymers (noted A and B) have been immersed in synthetic sea water. Pieces of films have been cut off in order to quantify water amount

Resin	16g	Copper oxide	18g
Solvent	40g	Iron oxide	3g
Phongall copper	6g	Red pigment	2g
Preventol A6*	4g	Titanium oxide	2g
Preventol A5**	3g	Zinc oxide	5g
Thixotropy agent	1g		

*: Preventol A6 - Diuron: 3-(3,4-dichlorophenyl)-1,1-dimethylurea
 **: Preventol A5-Dichlofluanide: N'-dichlorofluoromethylthio-N,N-dimethyl-N'-phenyl sulfamide
 ***: Thixotropy agent: castor oil

Figure 5: Resanbio formulation.

Table 4—Characteristics of the New Paint Without Organotin Derivatives

Formulation	Resanbio®	Blue	White
Erosion	Good	Good	Too much
Antifouling activity	Good	Good	— ^a
Shelf life	Limited	Good	Good

(a) Not realized.

Table 5—Mechanical Properties Before Immersion

Binder	Strength of Adhesion (Newtons) ^a	Type of Fracture
Biomet®	258 (18)	70% cohesive
Tin-free binder	88 (10)	100% adhesive

(a) 1 Newton = 1 m.kg.s⁻²

Table 6—Mechanical Properties After One Month of Immersion

Binder	Strength of Adhesion (Newtons) ^a	Type of Fracture
Biomet	326 (26)	75% cohesive
Tin-free binder	114 (12)	100% adhesive

(a) 1 Newton = 1 m.kg.s⁻²

present in the film by coulometry (see Figure 6).

In the case of the resin A: a regular increase of water absorption was observed during the first seven days of immersion. The film already contained 45% (weight) of water after this time. Then, the water amount reached a stabilized level until the 10th day. Afterwards, water rapidly gets in the film. After 17 days, the percentage of water present in the varnish film is high: 82%. This important uptake of water leads to a loss of mechanical properties of the film. This binder is hydrophilic.

In the case of the resin B: a regular increase of water was observed. However, the water quantity present in the varnish film stayed very low: 1.7% after 20 days of immersion. This binder has a hydrophobic character.

In the case of the Biomet resin: the water quantity present in the varnish film is lower than in the case of the resin B: 1.1% after 20 days of immersion. This binder has a profound hydrophobic character.

This study has demonstrated that the polymeric binder A absorbs a large amount of water during its immersion contrary to the organotin varnish that only contains about one percent of water after one month of immersion. Although their evolutions during immersion are very different, these two binders (A and Biomet) present the same erosion characteristics: they lead to erodable paints. The resin B, which absorbs about the same amount of water as Biomet, leads to a nonerodable paint.

Hydrolysis and Biocides Release

The ability of the two acrylic polymers for hydrolysis and biocides release was evaluated in vitro.

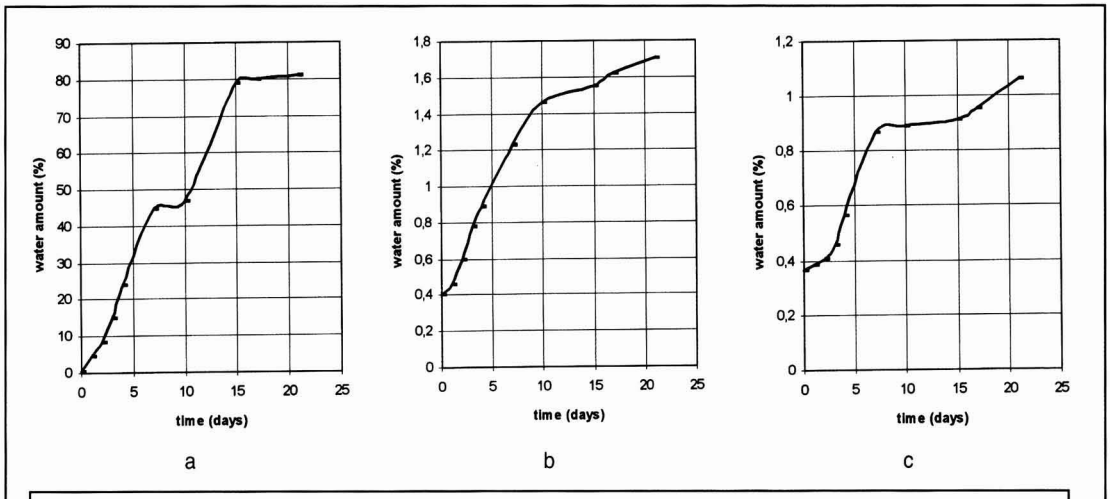


Figure 6—Water absorption of the new acrylic polymers: resin A (a), resin B (b), and of Biomet (c) during immersion.

In the case of resin A which contains hydrolyzable units: the product resulting from the hydrolysis of these units has been identified and quantified by GC-MS. Only one product of degradation has been found, R_3 -OH (benzoic acid) (see Figure 7).

A burst effect was observed during the first period (between the 10th and 40th days). After three months, 55% of the functions have already been hydrolyzed. Then, the hydrolysis was linear. The hydrolytic degradation of this polymer has been confirmed by ^1H NMR study of the film. A decrease of the signal due to charac-

teristic protons of the product R_3 -OH (ester group in the macromolecular chain of the binder) is observed. This decrease, a sign of hydrolysis, is illustrated by calculating the signal ratios of R_3 protons (I) and the other protons of the polymer (i). The results are described in Table 2.

In the case of the resin B without hydrolyzable units: no product resulting from the hydrolysis of the polymer was identified. This resin had ester function in lateral groups, but hydrolysis was not observed. All characteristics of the polymer are constant: T_g , composition (de-

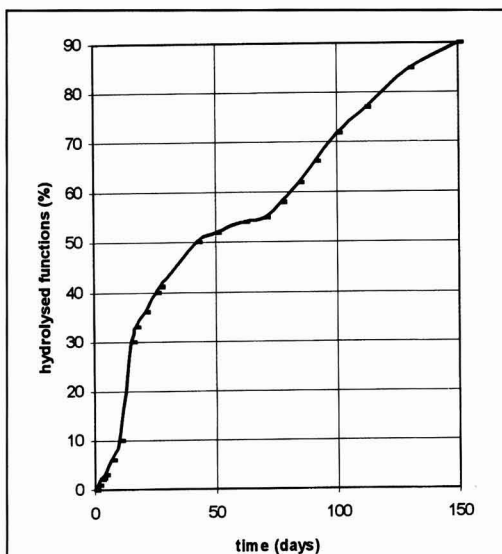


Figure 7—Study of the hydrolysis of the resin A by GC-MS.

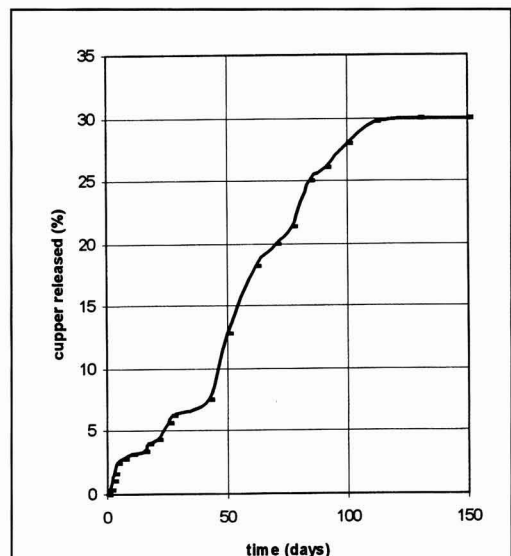


Figure 8—Release of copper during immersion in synthetic sea water for the resin A.

Biocide 1 : Phongall zinc Biocide 2 : Preventol A6

Figure 9—Biocides studied.

terminated by FTIR and ^1H NMR) and distribution of the molecular weight. No degradation was noticed. This resin does not answer to the prerequisites to realize erodable antifouling paints. Data shows that the chemical structure of the lateral ester group is very important in regard to the hydrolysis. Preliminary hydrolysis studies are necessary. The ability of the ester group in polymer to be degraded is very complex. Hydrolysis in the polymer is not as simple as hydrolysis in small molecules.

Simultaneously, the release of a biocide (cuprous oxide) from the matrix A was studied (Figure 8). The release profile displays a large quantity of biocide released during the first 100 days. These observations demonstrate that the binder degradation is gradual and enables a slow release of biocides such as cuprous oxide.

Study of the Effects of Fillers

It is well known that a paint's formulation determines the performance of the coating. In order to integrate this variable, to understand and to control the action of fillers and additives, we studied their effects on water penetration and binder hydrolysis. Various varnishes of resins A and Biomet were prepared by adding only one component of the formulation: cuprous oxide (Cu_2O), surface treated cuprous oxide (modified Cu_2O), titanium dioxide, zinc oxide, biocides 1 and 2, and the reference biocide (tributyltin TBT).

The water absorbed by the filled varnishes was studied by coulometry.

In the case of the resin A: fillers have a major influence on the behavior of this polymer in presence of water (Figure 5). Cuprous oxide minimizes the migration of water and has a regulation effect; this filled varnish keeps a hydrophobic character during the immersion. After seven days the water amount is low, 12%. This hydrophobic effect occurs when a surface treatment is applied to cuprous oxide. The varnish containing modified cuprous oxide absorbed more water after seven days of immersion, 22%. The paint that contains all the components of the formulation was the most marked hydrophobic character.

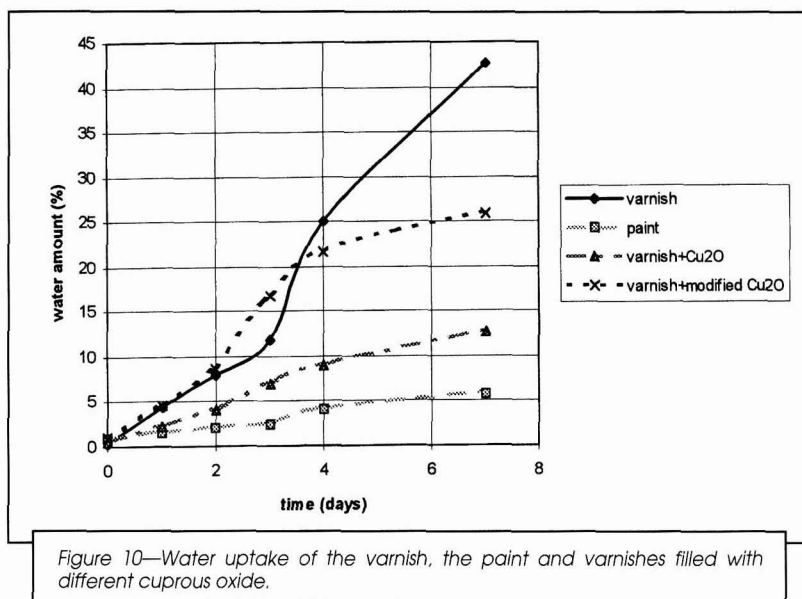
Biocides 1 and 2 and TBT enhance water penetration (see Figure 11). They influence the permeability of the binder. An explanation of this hydrophilic characteristic may be found in the chemical structure of these biocides, all of them possess polar functions.

Chemical analysis of the films has shown that all of the blended biocide was not dissolved.

Zinc oxide seems to have a slightly hydrophobic effect but it does not affect the binder properties significantly. Titanium dioxide enhances the film permeability; after seven days of immersion, the filled varnish absorbed 70% (weight) of water. These different results are summarized in Table 3.

These fillers and additives also affect the hydrolysis binder. The release of $\text{R}_3\text{-OH}$ due to the degradation of the hydrolyzable units of the was studied for two filled varnishes.

Experimental data show that a filler that slows down the water penetration also reduces hydrolysis rate. Nonfilled varnish hydrolyzes faster (55% of the functions are hydrolyzed after 74 days) than coating filled with cuprous oxide (25% of the functions are hydro-



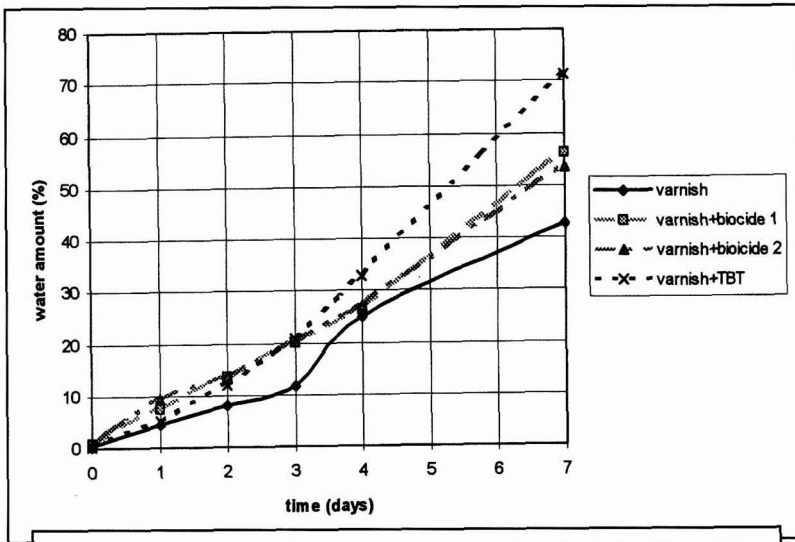


Figure 11—Water uptake of the varnish and varnishes filled with different biocides.

lyzed after 74 days). Fillers with hydrophilic or neutral properties increase hydrolysis rate. When TBT is blended with a binder, the degradation occurs more rapidly; 75% of the functions are hydrolyzed after 74 days of immersion. TBT promotes degradation only after a latent period of one month.

In the case of Biomef, fillers do not have the same influence on the behavior of the resin in presence of water. In all cases water absorption is limited, inferior to two percent after one month of immersion (see Figure 14). These observations show that the influence of fillers on the binder's permeability depends on the "filler-

binder" pair, the nature and the amplitude of the effects are different.

EVALUATION OF THE ANTIFOULING ACTIVITY ON NATURAL SITE

Polymer A was formulated in various ways. Antifouling action and erosion were controlled over 22 months for the different paints. The results are described in Table 4.

In the case of the Resanbio formulation containing cuprous oxide, erosion and antifouling action are excel-

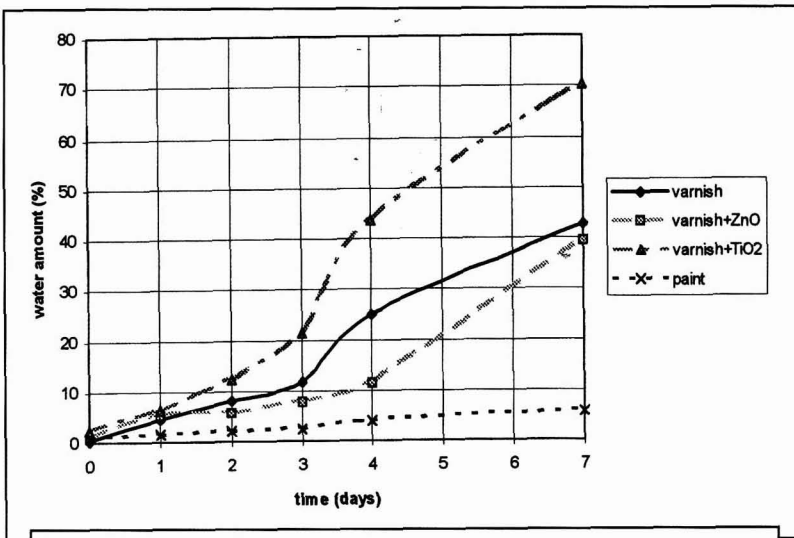


Figure 12—Water uptake of the varnish and varnishes filled with different metal oxides.

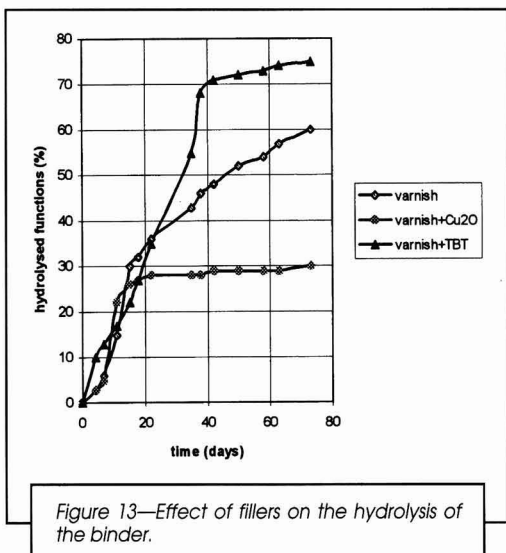


Figure 13—Effect of fillers on the hydrolysis of the binder.

lent. Panels exposed in natural sea water remained clean during their immersion (22 months, from August 1995 to May 1997). A primary slime was observed after two weeks of immersion, however, no growth of other fouling was observed. Erosion rate is good but shelf life problems appeared after three months of storage.

In the case of the Blue formulation containing modified cuprous oxide, erosion, antifouling protection, and shelf life are good.

In the case of the White formulation without cuprous oxide, paints are much too erodable and improper properties are obtained. A bad adherence to the substrate was observed. Stability of the coating viscosity was observed during the storage.

To a certain extent, these results also illustrate the fillers effect on the antifouling paints performances.

Mechanical properties of these paint films were studied by pull-off test during immersion. The reference paint contains organotin copolymers (Biomet). For each paint, five tests were conducted (the divergence is given in brackets). The type of fracture is mentioned in Table 5.

Before the immersion, the paint containing Biomet has the greater strength of adhesion, but the cohesive character of the fracture carries out a weakness of the film.

After one month of immersion, Biomet paint keeps good mechanical properties, but the fracture is always cohesive. The paint containing the new tin-free binder keeps its good mechanical properties too.

CONCLUSION

The protocol illustrated in this paper enables us to take into account all the factors involved in erosion and antifouling action to reveal chemical reactions that occur. Approaches to understand the influence of the resin chemical structure on the paint efficiency are offered. Various analytical methods (GC-MS, SEC, FTIR, NMR, ICP, coulometry) give complementary information about the phenomena of erosion and antifouling activity. Further examination of paint properties during immersion shows that fillers and additives have a strong effect on water penetration, hydrolysis, erosion, and shelf life. Cuprous oxide has a regulator influence on water penetration and hydrolysis, whereas biocides enhance the hydrolytic degradation. This protocol makes the fast and reproducible assessment of paints and the understanding of their antifouling properties possible. An illustration is given by the study of an efficient erodable antifouling paint. The polymeric binder has a variable

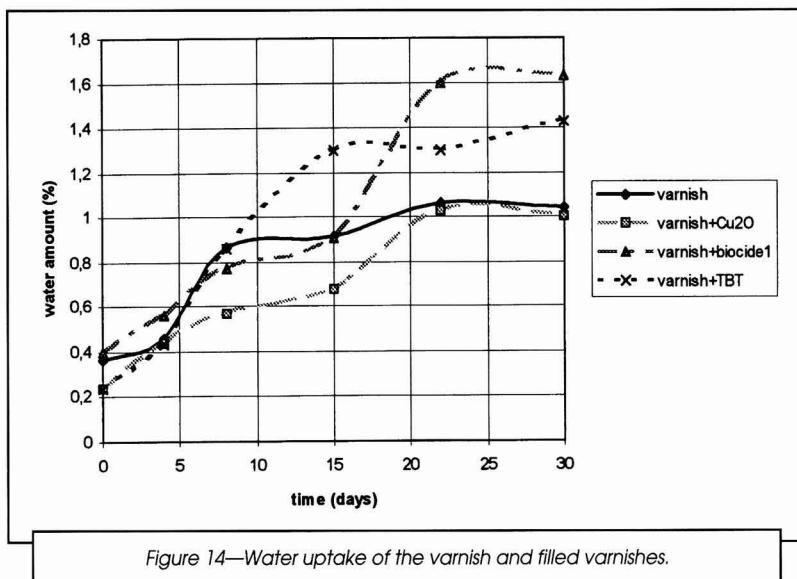


Figure 14—Water uptake of the varnish and filled varnishes.

hydrophilic/hydrophobic balance and bears hydrolyzable functions. The corresponding paints had a good erosion and antifouling rate since the beginning of immersion in natural sea water for 22 months.

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Photodegradation of Water-Based Acrylic Coatings Containing Silica

Alison M. Morrow, Norman S. Allen, and Michele Edge—Manchester Metropolitan University*

INTRODUCTION

Worldwide restrictions on the emission of volatile organic compounds (VOCs) into the atmosphere have forced the surface coatings industry to find more environmentally acceptable replacements to the traditional solvent-based systems currently in use. A number of alternatives have been developed including waterborne technologies. The replacement of organic solvents by water poses a number of challenges to both resin and additive manufacturers, particularly in the areas of film durability and the mechanical properties of cured coatings. The major component of any coating, whether it be solvent- or water-based, is the polymer resin. The photochemical instability of many polymers limits their use in coatings, especially those designed for exterior applications, such as exposure to sunlight for prolonged periods results in photodegradation. Despite extensive literature on photo breakdown mechanisms in polymers, confusion still exists with respect to the definition of photodegradation.

Photodegradation is defined as the chain scission and/or photocrosslinking of the polymer, initiated by the absorption of a photon of light. When this occurs in the presence of air, the process is known as photooxidation. Polymer degradation has been most actively studied in the class of polymers known as the polyolefins. It is generally assumed that the fundamental process underlying the photooxidation of polyolefins is a free radical chain mechanism resulting in the production of polymer hydroperoxides, which are critical intermediates in the photooxidation of many polymers.¹⁻³ The stability of these hydroperoxides is highly structure dependent and they are known to undergo secondary reactions giving rise to compounds containing hydroxyl, carbonyl, and vinyl groups.

One of the most important film-forming latexes used in waterborne coatings is acrylic resins. These are, for the most part, the acrylate and the methacrylate esters of lower alcohols, of which methanol and butanol have the widest application. Photodegradation studies of polymethyl methacrylate (PMMA) show extensive chain scission and the evolution of methyl formate, methanol, methane, carbon monoxide, carbon dioxide, and hydro-

The durability of acrylic copolymer systems containing silica as a matting agent is investigated, with particular emphasis on the photodegradation process. The effects of the photodegradation process on the films are monitored chemically via reflectance FTIR spectroscopy and UV spectroscopy and monitored physically via gloss levels, optical properties, film thickness, and film smoothness measurements of the cured film. The findings of this study show that as a result of photooxidation high levels of hydroperoxides are observed. In addition the FTIR results, which are discussed from a mechanistic point of view, indicate that functional group formations and crosslinking reactions which occur as a consequence of photodegradation, play a primary role. Therefore, this study suggests that silica can reduce the durability of acrylic based formulations and that the extent of this photodegradation appears to be dependent on silica type.

gen.^{4,7} Despite the close similarity in structure, the degradation behavior of polybutyl acrylate (PBA) differs greatly from that of PMMA. Crosslinking and formation of a high proportion of short chain fragments are characteristic of PBA breakdown, with only extremely small monomer yields.⁸⁻¹⁰ Latexes based on copolymers of methyl methacrylate (MMA) and butyl acrylate (BA) are currently being used in waterborne formulations. The differing glass transition temperatures (T_g) of these monomers yield copolymers with good film properties. Limited research into the degradation of MMA and BA copolymers has been carried out, however, Allen et al.¹¹ suggested possible mechanisms by which photooxidation can take place.

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Table 1—Typical Physical Properties of Silica A and Silica B

Property	Silica A	Silica B
Particle size (Malvern)/ μm	9.5	8.0
Surface area (BET)/ m^2g^{-1}	240	190
Pore volume (BJH)/ ccg^{-1}	1.35	1.15
Surface treatment	None	None

This paper documents part of an ongoing study into the durability of acrylic copolymer systems containing silica with particular emphasis on the photodegradation process. The role of silica within these systems is to produce a matt film. The photooxidation mechanism was evaluated by FTIR spectroscopy to show functional group changes and by colorimetric UV analysis to follow the photochemical generation of hydroperoxides. The effect of photooxidation on the gloss levels, the optical properties, film smoothness, and film thickness was also evaluated.

EXPERIMENTAL

Materials

Two copolymer systems were used in this study. The first (resin 1) was based on a methyl methacrylate, butyl acrylate system, and the second (resin 2) on a methyl methacrylate, butyl acrylate system containing styrene. It is believed that the sequences of MMA and BA are variable within the chain.

Two commercially available silicas used as matting agents in clear acrylic-based waterborne systems were selected: silica A and silica B. Typical physical properties of these silicas are summarized in *Table 1*.

These resins and silicas were incorporated into commercially available lacquer formulations (*Table 2*). In both cases the ingredients were added together in the order listed, one minute apart, and mixed at 2,000 rpm using a Heidolph high-speed stirrer fitted with a Cowles type stirrer head. The mixing speed was increased to 3,000 rpm after the silica was added. A formulation in which water replaced the silica was prepared for each system, and these were used as the controls. Once all the components had been added, the formulation was mixed for an additional 15 min at 3,000 rpm. The lacquers were left to deaerate before films were drawn down with a 100 μm (wet film thickness) K bar, which gave a dry film thickness of 30 μm . The films were left to dry at ambient temperature for 24 hr.

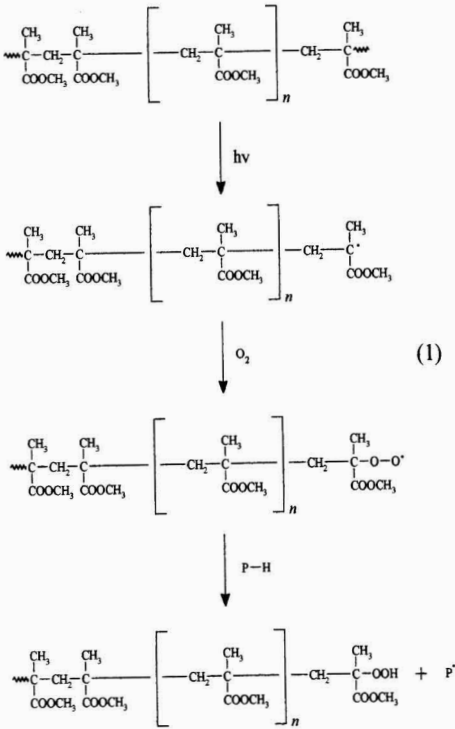
UV Irradiation

Accelerated photodegradation was carried out by irradiating the films in commonly used Microscal units (Microscal Ltd., London), fitted with a 500W high pressure mercury/tungsten lamp (wavelength > 300 nm). An operating temperature of 50°C was used with 50% relative humidity. Samples tested for hydroperoxide analysis, FTIR analysis, and film thickness were coated onto melinex whereas samples tested for matting, optical properties, and film smoothness were coated onto glass microscope slides.

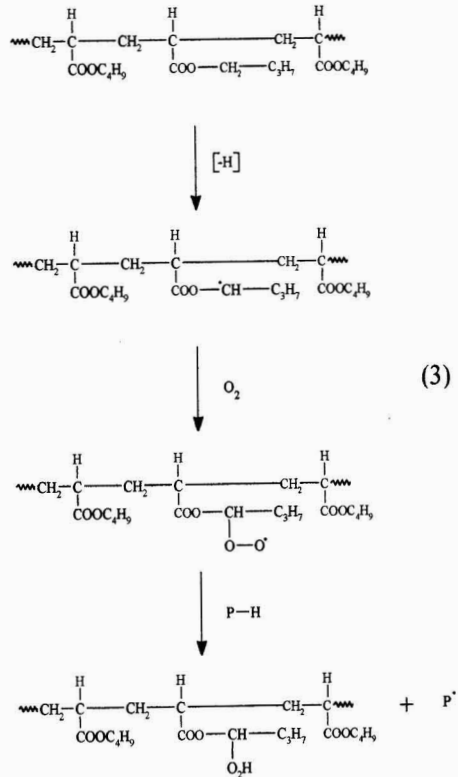
Table 2—Commercially Available Formulations Utilized in this Study

Formulation 1 (F1)	Formulation 2 (F2)
Resin 1 74.70 g	Resin 2 71.4 g
Estasol (coalescent) 2.99 g (Chemoxy International, Cleveland)	Water 16.80 g
Water 13.91 g	Tegofomex 1488 (defoamer) 0.20 g (Tego Chemie Service GmbH, Essen)
BYK 024 (defoamer) 0.15 g (BYK Chemie GmbH, Wesel)	Silica (matting agent) 2.50 g
Silica (matting agent) 3.50 g	Dowanol [®] PnB (coalescent) 3.81 g (K&K-Greiff Ltd., Croydon)
Glaswax E1 (wax) 4.00 g (Allied Colloids, Bradford)	Dowanol [®] DPnB (coalescent) 1.90 g (K&K-Greiff Ltd., Croydon)
BYK 024 (defoamer) 0.05 g (BYK Chemie GmbH, Wesel)	Tegofomex 1488 (defoamer) 0.05 g (Tego Chemie Service GmbH, Essen)
Troysol Lac (wetting agent) 0.20 g (Troy Chemical Company, Netherlands)	Troysol Lac (wetting agent) 0.50 g (Troy Chemical Company, Netherlands)
Nopco DSX 1550 (rheology modifier) 0.50 g (Henkel Performance Chemicals, Leeds)	Glaswax E1 (wax) 2.14 g (Allied Colloids, Bradford)
	Nopco DSX1514 (rheology modifier) 0.80 g (Henkel Performance Chemicals, Leeds)

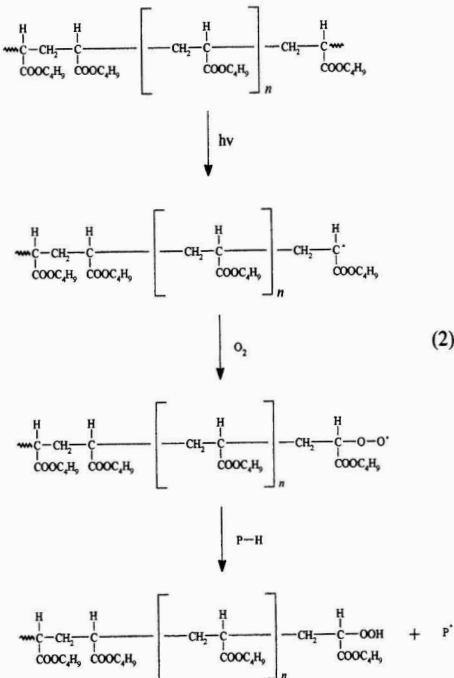
(a) These components were premixed.



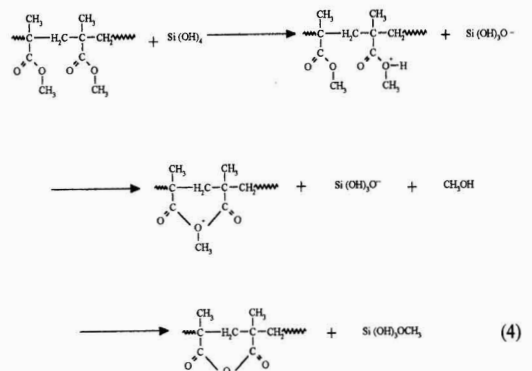
FORMATION OF TERTIARY HYDROPEROXIDES
Where P-H is the polymer chain



FORMATION OF PRIMARY HYDROPEROXIDES



FORMATION OF SECONDARY HYDROPEROXIDES



ANHYDRIDE FORMATION

Hydroperoxide Analysis

Hydroperoxide groups that are stable enough to accumulate to high concentrations may be detected by various methods.¹²⁻¹⁴ The method utilized here was the standard iodometric procedure outlined by Carlsson and Wiles.¹⁵

FTIR Analysis

Functional group changes were monitored by the use of reflectance FTIR spectroscopy. A Bio-rad SPC 3200 FTIR spectrophotometer was used. Difference FTIR spectra were considered as some of the FTIR changes are small but these changes could be marked significantly by small variations in the thickness of the film over the area of analysis.

Cured Film Properties

The effect of photodegradation on the cured film properties was monitored by measuring the following properties of the drawn films: gloss levels (using a Trimicrogloss 20-60-85, 160, glossmeter), optical properties (using a BYK-Gardner haze-gard plus haze meter), film thickness (using a Mitutayo precision digital micrometer) and film smoothness (using a Taylor-Hobson, surtronic 3P smoothness tester).

RESULTS AND DISCUSSION

Hydroperoxide Analysis

Figures 1 and 2 show the formation of hydroperoxides during the photooxidation process as a function of time. The changes in hydroperoxide levels appear to be dependent on the formulation used. For formulation 1 (F1), higher levels of hydroperoxides are observed for the matted system, while for formulation 2 (F2) the matted and the unmatted systems produce similar levels of hydroperoxides. At this stage the results are independent of the silica matting agent utilized. The formulations used differ both in terms of the resin and other additives employed. For example, F1 uses BYK 024 as the defoamer compared to Tegofoamex 1488 in F2. It is possible that one or more of these reagents in F1 as well as the polymer is undergoing photooxidation, thereby increasing the level of hydroperoxides, or it could be that a component of F2 is acting as a radical scavenger such as an amine-based reagent. Another possible explanation is that the inclusion of styrene in resin 2 is adding stability to this system by acting as a blocking agent in the unzipping mechanism of photodegradation of PMMA.

The hydroperoxide curves (Figures 1 and 2) fluctuate considerably because the rates of decomposition and formation of hydroperoxide depend on the type of hydroperoxide group. The measured levels of hydroperoxide in these systems are high, approximately 800-1000 $\mu\text{g ml}^{-1}$; typical values for other systems (e.g., polypropylene) are around 300 $\mu\text{g ml}^{-1}$.¹⁶ It is possible that the

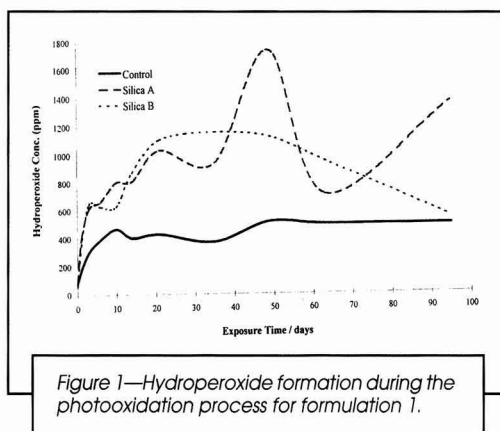


Figure 1—Hydroperoxide formation during the photooxidation process for formulation 1.

observed hydroperoxide levels are due to tertiary hydroperoxides as these are known to be relatively stable.¹ The tertiary hydroperoxides could form on the PMMA chain as a result of oxidation occurring at the tertiary carbon before chain branching oxidation reactions form other products such as ketones and carboxylic acids¹⁷ [see equation (1)]. In the case of PBA, two types of hydroperoxide are likely to be produced. The first is associated with main chain oxidation and will give rise to less stable secondary hydroperoxides [equation (2)], while the second, which gives rise to unstable primary hydroperoxides, is linked to side-chain oxidation of the methylene adjacent to the ester function [equation (3)].

FTIR Analysis

Chemical changes in the structure of the lacquers were measured by FTIR spectroscopy as shown in Figures 3-8. This technique has been widely used to follow the photooxidative behavior of many polymers.¹⁷ To simplify the complex changes occurring in functionality as the films age, the study concentrates on the following formations: acid anhydride, lactone, acetophenone, vinyl ketone, and vinyl. In addition to these formation reactions, crosslinking mechanisms may occur and these are also discussed.

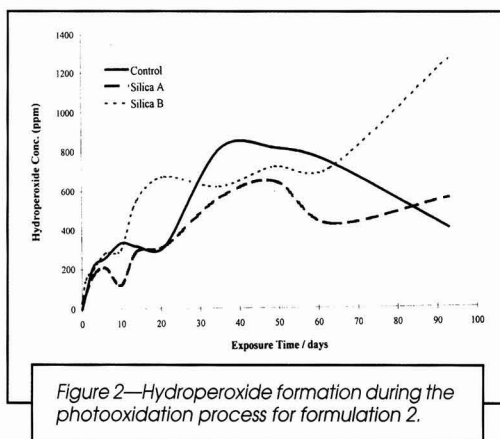


Figure 2—Hydroperoxide formation during the photooxidation process for formulation 2.

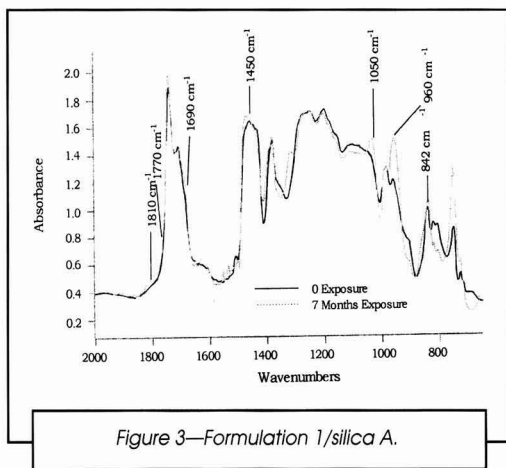


Figure 3—Formulation 1/silica A.

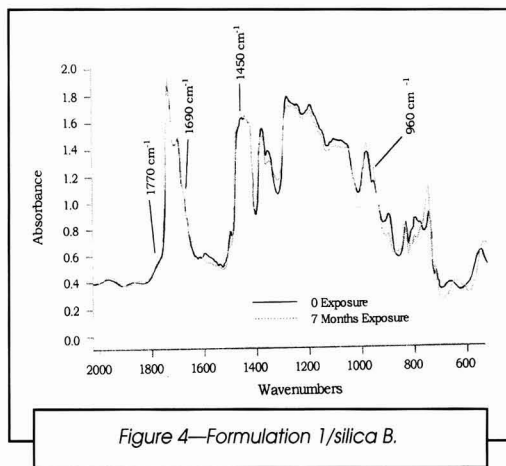


Figure 4—Formulation 1/silica B.

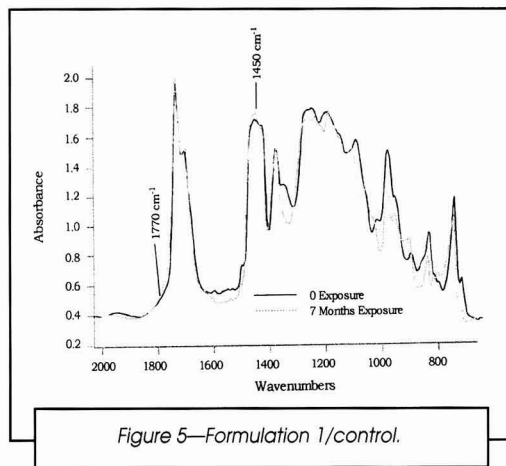


Figure 5—Formulation 1/control.

Anhydride Formation

In both F1 and F2, where silica A was employed as the matting agent, a new absorption band at 1810 cm^{-1} was formed (Figures 3 and 6). This possibly may be attributed to anhydride formation which would occur as a result of a cyclization reaction involving PMMA and free silanol groups which would be present within the pores of silica A [equation (4)].¹⁸ No such absorption appears in the control samples or for the silica B samples (Figures 4, 5, 7, and 8) suggesting that for this photodegradation pathway, silica A is aiding photooxidation while silica B is having little or no effect.

Lactone Formation

In all samples studied (Figures 3-8), the formation of a shoulder on the carbonyl absorption at 1770 cm^{-1} is observed, a possible indication of lactone formation. Equation (5) proposes a possible route for the generation of such a lactone group.¹⁹ This process has previously been reported in conjunction with thermal degradation, however, the mechanism also appears to occur under prolonged irradiation.

Acetophenone Formation

In Figures 6-8 a new absorption is observed at 1703 cm^{-1} . This only occurs with F2 films. The absorption for the control (Figure 8) and the silica B sample (Figure 7) is smaller than that for the silica A sample (Figure 6). It is possible that the absorption at 1703 cm^{-1} is associated with the styrene present only in resin 2, since UV irradiation of polystyrene is known to result in acetophenone end group formation² [equation (6)]. The formation occurs as a result of the photodecomposition of hydroperoxide groups on the polystyrene. As the observed adsorption is higher for the silica A sample than for the silica B sample, it would appear that silica B causes less photodegradation than silica A.

Vinyl Ketone Formation

When comparing the control with the samples containing silica, it can be seen that a shoulder is forming at 1690 cm^{-1} (Figures 3, 4, 6, and 7). This can be attributed to vinyl ketones, which may be produced by a number of different light induced reactions on PMMA [equation (7)]. Since no vinyl ketone formation is observed in the control samples, it is possible that the matting agents are promoting photooxidation in this case.

Vinyl Formation

It can be seen from Figures 3 and 6 that there is an increase in the absorption bands occurring at 960 and 842 cm^{-1} . These may be attributed to vinyl group formation: trans vinyl at 960 cm^{-1} and vinylidene at 842 cm^{-1} . It is possible that the photodegradation mechanism of PMMA after long periods of irradiation is similar to its thermal degradation mechanism, which is simply a reverse of polymerization (unzipping)¹⁶ thus leading to very high monomer yields [equation (8)]. It has also

been reported²⁰ that on photodegradation of copolymers of MMA and BA, short chain fragments are produced. These chain fragments are believed to be formed in an intramolecular transfer process that introduces terminal carbon-carbon unsaturation [equation (9)].

It can be seen from Figure 8 that only the trans vinyl absorption increases for the control in F2, and that in F1 (Figure 5) vinyl formation does not occur. Furthermore, in the samples containing silica B (Figures 4 and 7), trans vinyl formation has only been observed in F1 films. It is therefore possible that silica, in particular silica A, is enhancing degradation in terms of photodecomposition to form vinyl groups.

Crosslinking Reactions

The presence of one or more of the following absorption bands suggests that crosslinking is occurring as a result of the light induced reactions on PMMA and PBA; 1600, 1450, 1352, and 1210 cm^{-1} . The effects of UV irradiation on PMMA and PBA differ considerably. PBA simultaneously undergoes chain scission and crosslinking [equation (10)], whereas PMMA has no tendency to crosslink when irradiated. For the films produced from F1, the 1450 cm^{-1} absorption is present in all samples (Figures 3-5). Considering films drawn from F2, samples containing silica A have all of these absorptions (Figure 6) whereas silica B has only the 1600 cm^{-1} band (Figure 7). The control shows all the absorptions except the one at 1210 cm^{-1} (Figure 8). Furthermore the absorption at 1050 cm^{-1} in F2 films (Figure 6) and 1040 cm^{-1} in F1 films (Figure 3) shows a large increase when silica A is present. The observed absorption is due to the ether vibration of the ester group, formed by a crosslinking reaction²¹ [equation (11)]. The absorption at 1600 cm^{-1} (a conjugation absorption) present in all of the F2 samples, can possibly be assigned to the formation of dienes, a reaction which is known to occur on UV irradiation of polystyrene. It would therefore seem that the type of crosslinking occurring is dependent on the resin composition. The absorptions relating to these crosslinking reactions are more prevalent in silica A than in silica B, suggesting that silica B causes less photooxidation than silica B, in terms of crosslinking.

Cured Film Properties

Over an irradiation period of about three months, no significant change was observed in either the optical properties or the gloss levels of the matted systems based on F1 and F2. Film smoothness and film thickness also showed little variation.

CONCLUSION

The findings of this paper suggest that the formulations containing silica show more signs of degradation than the formulations without silica. Although the hydroperoxide levels of the matted and unmatted systems in F2 are similar, in F1 the hydroperoxide levels are much higher in the matted system. This suggests that the matting agent reduces the stability of the F1 system, how-

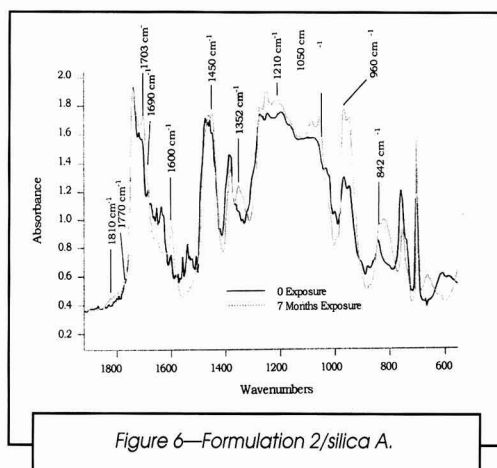


Figure 6—Formulation 2/silica A.

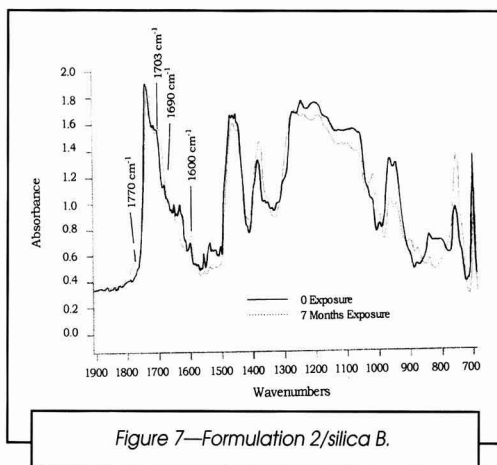


Figure 7—Formulation 2/silica B.

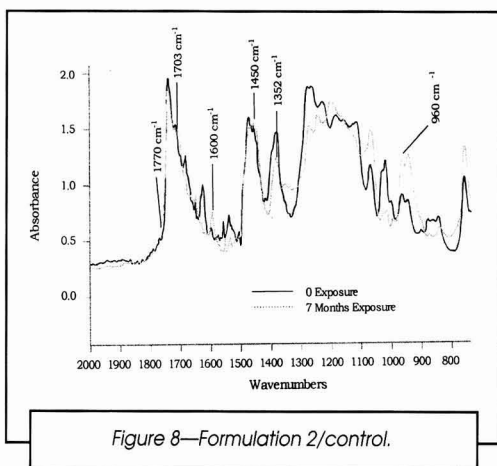


Figure 8—Formulation 2/control.

ever, longer periods of irradiation are required before definite conclusions can be drawn.

From the FTIR results, a number of functional group changes and crosslinking reactions have been identified from new or increased absorptions observed over the seven month exposure period. Since there are differences in the spectra of F1 films compared with F2 films, the type of crosslinking reactions occurring would appear to be dependent on resin composition. Spectral changes can be associated with the products from photooxidation and as there are many more changes for the samples containing silica compared with the control samples, it is likely that the silica is also playing a role in film degradation. An explanation as to why silica plays a role in the film degradation is that the metal ions, present in the silicas as impurities from processing, could be catalyzing the photooxidation degradation of the films. The level of metal ions present in the two silicas differ but as it is thought that a certain level of metal ions will enhance degradation, any further increase will have no effect as a plateau will have been reached. This work also suggests that the silica type (e.g., pore volume and surface area) can affect the mechanism by which photodegradation occurs, as well as its extent; silica A forming more photodegradation products than silica B. A reason for this difference in extent of photooxidation could be related to the adsorbed and associated water contents of the silicas. Silica A has a low adsorbed and associated water content, and it also contains free silanol groups within the silica pores whereas silica B does not.

From studies on the cured films, no conclusions on the effects of photodegradation on the physical properties of the cured films can be drawn.

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Novel Ambient Temperature Curable Two-Component Waterborne Silicone-Acrylic Coatings

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INTRODUCTION

Environmentally friendly coatings have been developed to meet VOC regulations around the world.¹⁻³ There is also strong demand to develop an isocyanate-free and ecologically safe coating system that provides excellent film properties similar to those of two-component (2K) ambient-cure acrylic urethane systems.^{4,6}

An ambient curable waterborne (WB) coating is one of the candidates for such demands. However, WB coatings generally are composed of resins containing hydrophilic functional groups (e.g., neutralized carboxylic acid groups, polyethylene oxide groups, etc.). These groups usually remain in the final coating film and can have a negative effect on film properties such as weatherability and resistance to water and alkali. Therefore, it is generally believed that WB coatings cannot provide the excellent film properties of conventional organic solvent types.

One approach is to reduce the content of hydrophilic groups in the resin to the minimum for preparation of the WB resin so that the concentration of functional groups remaining in the film can be reduced. Such an approach however, is not likely to result in excellent film properties.

There are other approaches⁷⁻⁹ for ambient curable WB coatings, however, they are expected to have some drawbacks on the film properties. For instance, a film made from a one-component waterborne silicone-acrylic resin system has poor solvent resistance. In this system the self-condensation of alkoxy silyl groups can occur in the dispersing particles in water but insufficient inter-particle crosslinking occurs after formation of the film.

The 2K WB acrylic-urethane system provides a cured film having poor water resistance caused by the remaining hydrophilic groups and unreacted hydroxyl groups. The 2K WB epoxy curing system also provides a film having poor water resistance caused by the remaining hydrophilic groups in a poly-epoxy hardener or the unreacted functional groups.

Waterborne coatings are composed of resins containing hydrophilic functional groups. These groups usually remain in the coating film and can adversely affect film properties such as weatherability and resistance to water and alkali. We have developed a novel ambient temperature curable waterborne two-component system, in which the hydrophilic functional groups are consumed by the crosslinking reaction. The new coating system consists of a waterborne acrylic resin containing both tert-amino and carboxylic acid groups and a hardener containing both epoxy and alkoxy-silyl groups. The waterborne silicone acrylic coatings provide superior film properties even if the acrylic resin has relatively low functional group content.

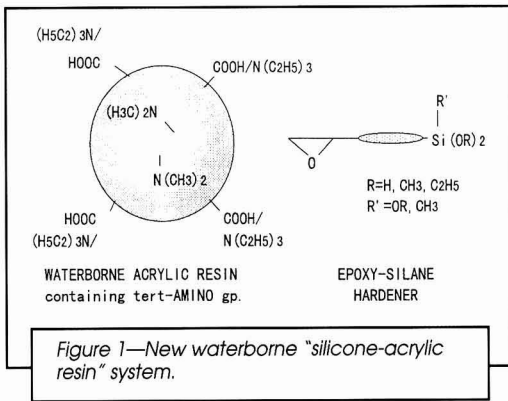
In this paper we describe the crosslinking reaction mechanism and film properties using some acrylic resin types and paint formulations as examples.

We have studied the isocyanate-free and ambient temperature curable WB 2K coating system, in which hydrophilic functional groups can be consumed by the crosslinking reaction and which can overcome the defects of the conventional WB system.

The system studied consists of a waterborne acrylic polymer containing carboxylic acid groups neutralized with a tert-amino compound, and an epoxy-silane compound (e.g., γ -glycidoxypropyltrimethoxysilane (γ -GPTMS)) as the hardener (see Figure 1).

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In this system, since the hardener is mixed with the waterborne acrylic polymer just prior to use and the mixture used before the condensation of silyl group is complete, the system can provide sufficient curability.

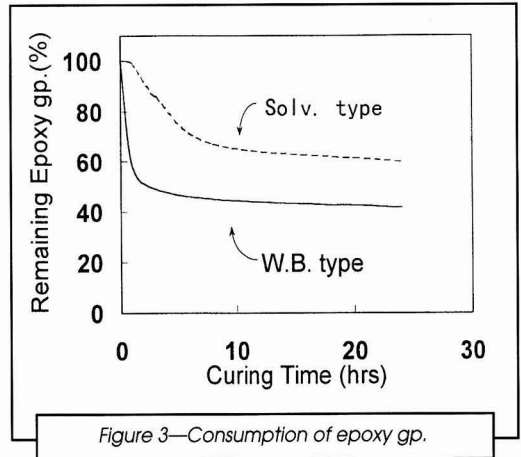
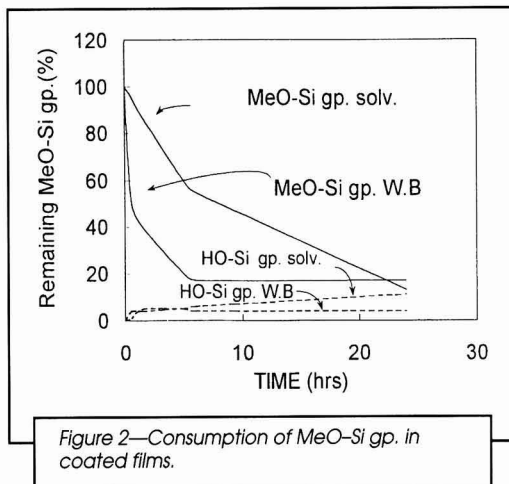
Curing takes place via three reactions:

- (1) the reaction between the tert-amino groups of the WB resin and the epoxy groups of the hardener;
- (2) the reaction between the carboxylic acid groups of the WB resin and the epoxy; and
- (3) the condensation reaction of the silyl groups.

In this paper we describe the crosslinking reaction mechanism of the system, the typical film properties of this crosslinking system, and the distribution of Si atoms in the film.

EXPERIMENTAL MATERIALS

Model A of Acrylic Resin Solution Type: Styrene-(meth)acrylate co-polymer containing 3.3 wt% of dimethylamino-ethylmethacrylate (DM) and 3 wt% of acrylic acid (AA) (on total monomers) in methyl ethyl ketone (MEK), non-volatile content (=60 wt%, viscosity =



$U^2 - V$ (Gardner 25°C). This acrylic resin solution was diluted to 30% (NV) by organic solvents (xylene/butylacetate = 70/30 wt%).

Model B of WB Resin Type: The same acrylic resin described previously was neutralized with triethylamine (TEA) so that the molar ratio of TEA to AA was 1:1. Water was added to the neutralized resin to form WB resin (Dispersion: NV = 30%).

Model C of Acrylic Resin Solution Type (used only for FTIR analysis): Styrene-(meth)acrylate co-polymer containing 5 wt% of DM and 10 wt% of acrylic acid (AA) (on total monomers) in MEK, non-volatile content (NV = 57.7 wt%, viscosity = $Z_6^2 - Z_7$ (Gardner 25°C). This acrylic resin solution was diluted to 30% (NV) by organic solvents (xylene/butylacetate = 70/30 wt%).

Model D of WB (used only for FTIR analysis): The same acrylic resin described earlier was neutralized with TEA so that the molar ratio of TEA to AA was 1:1. Water was added to the neutralized resin to form WB resin (NV = 30%).

Table 1—Reactivity of Varied Epoxy-Silane Hardeners

Epoxy-Silane Hardener	Gel-fraction %	MEK rubbing
Gly-CH ₂ CH ₂ CH ₂ -Si(OCH ₃) ₃	95	Excellent
Gly-CH ₂ CH ₂ CH ₂ -Si(OCH ₃) ₂ CH ₃	90	Good
$\left[\begin{array}{c} \text{OCH}_3 \\ \\ \text{O-Si} \\ \\ \text{CH}_3 \end{array} \right]_2 \left[\begin{array}{c} \text{-(CH}_2\text{)}_3\text{-Gly} \\ \\ \text{O-Si} \\ \\ \text{CH}_3 \end{array} \right]_2$	88	Poor
$\left[\begin{array}{c} \text{-(CH}_2\text{)}_3\text{-Gly} \\ \\ \text{O-Si} \\ \\ \text{CH}_3 \end{array} \right]_4$	87	Poor

Gly: Glycidyl group

Table 2—Paint Formulations

WB Silicone Acrylic Resin	Acrylic-Urethane (Solvent Type)	Conventional Acrylic Emulsion
Amino/carboxylic acid	Acrylic polymer ^a	Styrene acrylic emulsion polymer ^a
functional acrylic polymer ^b	32.87	57.9
TEA	TiO ₂ ^h	Deionized water
1.17	18	7.76
Deionized water.....	Thinner	10% sodium tripolyphosphate
34.77	35.04	0.5
TiO ₂ ^h	(Xylene/butylacetate=70/30)	Polyoxyethylenonyl-.....
19.11	Polyisocyanate resin ^f	0.24
Epoxy silane hardener ^b	14.09	phenylether (HLB=12)
4.21	Total	28% aq. NH ₄ OH
Total	100	0.05
		Ethylene glycol
		1.92
		TiO ₂ ^h
		26.63
		2,2,4-trimethyl-1,3-pentanediol
		monoisobutyrate
		5
		Total
		100
Solv. Silicone Acrylic Resin		
Amino-functional acrylic polymer ^c ..		
43.57		
TiO ₂ ^h		
17.28		
Thinner		
31.75		
(Xylene/butanol=70/30)		
Epoxy silane hardener ^d		
7.4		
Total		
100		

(a) Watersol YW-559: Product of Dainippon Ink and Chemicals Inc.; acrylic polymer containing tert-amino groups and carboxylic-acid, non-volatile content=59-61%. Solvent=propylene glycol mono-iso-propylether

(b) Watersol WW-565: Product of Dainippon Ink and Chemicals Inc.; hardener containing an epoxy-silane.

(c) Acrylic A-9510: Product of Dainippon Ink and Chemicals Inc.; acrylic polymer containing tert-amino groups. Non volatile content=49-51%. Solvent=toluene and iso-butanol.

(d) Acrylic A-9585: Product of Dainippon Ink and Chemicals Inc.; hardener containing an epoxy-silane. Effective solid content=80%.

(e) Acrylic A-801-P: Product of Dainippon Ink and Chemicals Inc.; acrylic polymer. OHV=47-53. Non-volatile content=49-51%. Solvent=toluene and ethylacetate).

(f) Burncoq DN-950: Product of Dainippon Ink and Chemicals Inc.; polyisocyanate resins. NCO content=12-13%. Non-volatile=74-76%. Solvent=ethylacetate).

(g) Voncoat EC-889: Product of Dainippon Ink and Chemicals Inc.; styrene-acrylic emulsion polymer. Non-volatile content=49-51%. Viscosity=200-1500cps. pH=8.0-10.0. MFT(°C)=28).

(h) Tlpaque R-930: Product of Ishihara Sangyo Kaisha Ltd., rutile titanium dioxide, 93% assay. Meets ASTM D 476, type IV. Specific gravity=4.2.

Model Hardener: γ -Glycidoxypopyl trimethoxysilane (γ -GPTMS, γ -Methacryoxypropyltrimethoxysilane (γ -MPTMS), γ -Glycidoxypopyl-methyldimethoxysilane, γ -Methacryoxypropylmethyldiethoxysilane, and the other silicone compounds listed in Table 3 (produced by Nippon Unicar Co. Ltd. and Toray Dow Corning Silicone Co., Ltd.) were used without any further purification.

RESULTS AND DISCUSSION

We studied the crosslinking reactions using model compounds. What we tried to elucidate are the reaction on silyl and epoxy groups of the hardener and the influences of water and amine neutralizer on curing. While many studies have been done to elucidate the reactivity of alkoxy silane compounds,¹⁰ there are few studies of the reactivity of the silyl group in polymers or coating films.¹¹⁻¹⁴

Crosslinking Mechanism

To determine the kinetics of the self-condensation reaction of the silyl groups in the films made from the waterborne silicone acrylic resin system and to take the influence of functional groups in the polymers into consideration (1) Model A + γ -MPTMS and (2) Model B + γ -MPTMS were employed. In this case, γ -MPTMS was selected to replace γ -GPTMS which generates OH functionality from the epoxy-carboxylic acid addition and complicates the determination. The mixtures were coated on the KBr plate and KRS plate, respectively. The absorption intensity changes of the functional groups were measured by FTIR (Si-OH: 3400-3450 cm⁻¹; Si-OCH₃: 820 cm⁻¹). The Si-OH group was determined using a calibra-

tion curve which had been prepared previously by the relationship between the varied Si-OH group content of diphenyldisilanol in γ -MPTMS and the corresponding intensity of the absorption. The results are plotted in Figure 2.

More than 80% of the -Si-OCH₃ group was hydrolyzed within six hours in the WB system, and approximately five percent of -Si-OH group (based on the corresponding initial -Si-OCH₃ group as 100%) was detected constantly during the cure reaction. The condensation reactions are faster in the WB system than those in the corresponding organic solvent type due to the influence of the water medium.

Next, for the easier determination of epoxy groups by IR spectra, Models C and D, which have more functional

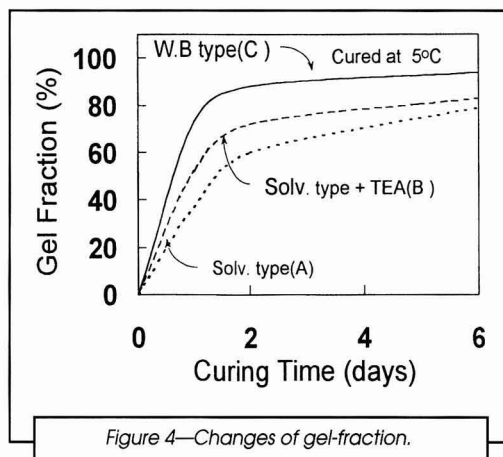


Figure 4—Changes of gel-fraction.

Table 3—Film Properties

	WB Silicone Acrylic Resins	Solv. Silicone Acrylic Resin	Acrylic-Urethane (solvent type)	Convention Acrylic Emulsion
Gloss 20	78	79	85	26
60	89	89	92	74
Pencil hardness	F	H	F-H	<6B
Gel fraction %	95	94	91	77
MEK rubbing 1.5kg/100 times	Excellent	Good	Excellent	Poor
Alkali resistance 5% NaOH r.t, 24 hr	Excellent	Excellent	Excellent	Excellent
Acid resistance 5% H2SO4 r.t, 24 hr	Excellent	Blister 6D	Excellent	Excellent
Impact resistance cm	50<	30-35	50<	50<
(DuPont 1/2", 500 g)				
Water resistance	Excellent	Excellent	Excellent	Poor
(immerse in water r.t. 7 days)				
Adhesion				
Steel	100%	100%	100%	100%
after the test	100%	100%	100%	0%
(blister box 50°C R.H.-98%, 24 hr)				
Aluminum	100%	100%	0%	50%
after the test	100%	100%	0%	90%
Chrome plate	100%	100%	60%	100%
after the test	100%	100%	60%	0%
Stainless steel	100%	100%	100%	100%
after the test	100%	100%	100%	0%
Slate	100%	100%	90%	90%
after the test	80%	90%	80%	0%
(immerse in water r.t. 7 days)				

Curing condition: r.t. for 7 days.

groups than the actual film forming resins (e.g., the model B resin), and the corresponding amount of γ -GPTMS were used. The consumption of the epoxy group is also faster in the WB system than in the corresponding organic solvent type as shown in Figure 3.

Figure 4 shows the changes with time of the gel-fraction in the cured films made from the acrylic polymers and the hardener:

- (a) Composition A: Model A (containing tert-amino group and carboxylic acid group) and γ -GPTMS.
- (b) Composition B: Model A neutralized with TEA in the organic solvent and γ -GPTMS.

(c) Composition C: Model B (the neutralized A in water) and γ -GPTMS.

The comparison of the changes in gel-fraction among the three compositions shows that TEA acts as a catalyst for the crosslinking reaction; and water also can accelerate the crosslinking reaction.

Stress-strain testing of cured films formed from water-borne silicone acrylic systems with AA content 2% and 4% was carried out to examine the contribution of the carboxylic acid group to the crosslinking reaction. The stress-strain curve (Figure 5) shows that the tensile strength increases with the content of the carboxylic acid group. In

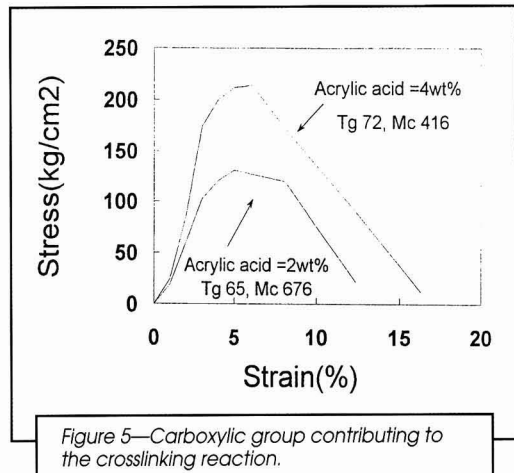


Figure 5—Carboxylic group contributing to the crosslinking reaction.

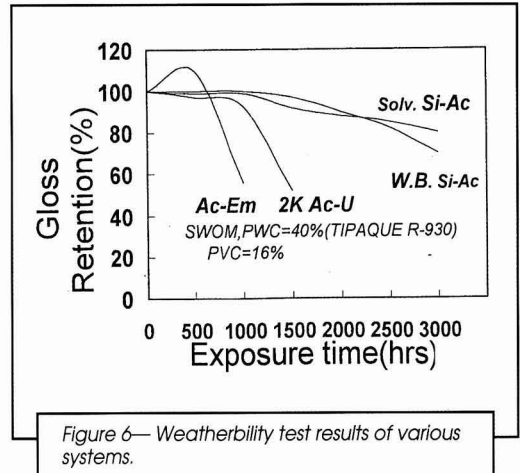


Figure 6—Weatherability test results of various systems.

Table 4—Distribution of Si Atom^a in the Film

Plate	Surface (Air)/Film)	Inside Film	Reverse Film/(Plate)	Interface (Film)/Plate
Aluminum	0.4	0.9	2.2	0.4
Polypropylene	0.6	0.6	0.7	—

(a) Atom %: analyzed by XPS.

addition, the glass transition temperature (T_g) and the crosslinking density (1/Mc) increase with the increase in the content of carboxylic acid groups. This suggests that the carboxylic acid group contributes to the crosslinking reaction even at room temperature.

In conclusion, the results presented indicate that the crosslinking reactions in this curing system are preferable to the WB ambient curing system.

For the selection of silicone compounds, the crosslinkability of the varied "Epoxy-Silane" hardener cured with Model Compound B was measured (Table 1). The condensed hardeners show lower reactivity than the monomeric epoxy-silane hardener.

These results suggest that the condensation reaction on the silyl group and on the epoxy group site of the monomeric epoxy-silane proceed at the same time, since, if the condensation reaction was completed before the reaction on the epoxy group site, the crosslinkability would be expected to be lower than it is.

Concerning the "pot-life" at room temperature after mixing Model Compound B with epoxy-silane hardeners, the composition using the monomeric epoxy-silane hardeners has a longer pot-life (24–48 hr) than those using the condensed hardeners (<5 hr).

These results indicate that the condensed hardeners react only at the surface of the particles of Model B (waterborne dispersion type) to shorten the pot-life and to lower the gel-fraction. On the other hand, some molecules of the monomeric hardeners react at the surface of the particles and the others can penetrate and react in the particles. Therefore, the monomeric hardeners can provide relatively longer pot-life and better MEK resistance (Table 1).

Film Properties

We have developed a new WB silicone-acrylic resin system employing this crosslinking technology.¹⁵ The paint formulations and the basic film properties of the system are compared with other systems in Tables 2 and 3, respectively.

The film made from the WB silicone-acrylic resin system shows similar film properties to the conventional 2K

solvent type such as the solvent silicone-acrylic resin system and the acrylic urethane systems and better film appearance and higher hardness than the acrylic emulsion. Furthermore, the WB silicone acrylic resin system provides good adhesion—as good as the solvent type silicone-acrylic resin. The cured film made from the WB silicone-acrylic resin system shows a "self-stratification" structure in the film when applied on metal plates,¹ as shown in Table 4. Composition C described earlier in this paper was applied on each substrate and cured at room temperature for seven days. The coated films were submitted to XPS (X-ray photo electron spectroscopy) analysis.

The Si atom of the hardener tends to concentrate at the interface between the film and aluminum plate. It is considered that the epoxy-silane compound as the hardener in this system works as a coupling agent between the film matrix and the metal substrate, resulting in excellent adhesion as shown in Table 3.

With weatherability, the WB silicone-acrylic resin system shows better performance than the conventional acrylic emulsion and the 2K acrylic urethane system as shown in Figure 6.

CONCLUSION

The crosslinking behavior of the silicone-acrylic resin system has been explicated in the course of this study. We are convinced that the silicone-acrylic resins system using the crosslinking technology described here can overcome at least some of the defects of conventional waterborne systems.

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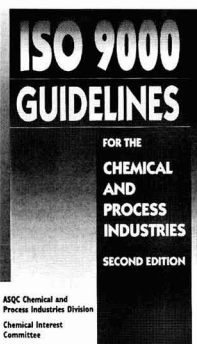
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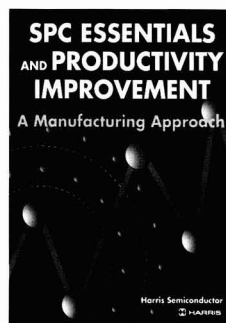
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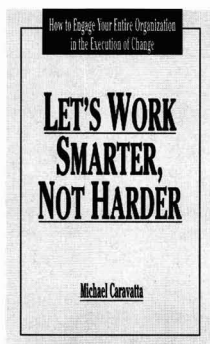
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Juergen H. Braun—Pigments Consultants, Inc.*

Successes in the development of tests for pigment characterization have contributed greatly to successes of the industry. However, problems with the evaluation of performance have slowed progress in some areas of pigment development. Characterization involves measurement of identifiable physical and chemical characteristics of a pigment by itself: composition, size, surface, structure, etc. Performance evaluations involve systems: paints and paint films. Complexity of the systems contributes to testing problems.

Usually, performance tests try to simulate the real world. The closer to reality the test, the more convincing is its result. Test paints resemble, and often are, commercial paints. But commercial paints are formulated to minimize performance differences among ingredient batches or suppliers. The formulations are thus designed to be insensitive to the performance characteristic at stake.

Model paints can be formulated for sensitivity to pigment performance but then they are not practical paints. A dilemma arises. *Results from a commercial paint are convincing but not sensitive to the pigment performance. Data from a model paint is sensitive to the pigment but not convincing.*

Optical performance testing is least affected because of impressive instrumental progress. Hiding power, tinting strength and color can now be tested quantitatively, reliably, and reproducibly. Relative Standard Deviations of $\pm 5\%$ are typical. *Testing of durability, mechanical and chemical performance has become a bottleneck to progress. Results can usually only be ranked^d but not quantified and can rarely be reproduced to even modest satisfaction.* Uncertainties, Relative Standard Deviations, of 30-40% of value are typical. Problems are aggravated because the coatings industry overestimates the reliability and reproducibility of test results. *Still, it is not enough that a test reproduces well. In addition, it must be sensitive enough to reproduce small differences between similar pigments.*

Statistical evaluation of performance data would certainly help. Statistical quality control saves future expense but costs up-front money. Appreciation of statistics and statistics-based quality management is penetrating only slowly into pigment and paint laboratories and has yet to make significant inroads into manufacture and management.

OPTICAL PERFORMANCE

Until recently, the appearance characteristics of pigments and paint films were evaluated by visual comparisons. The eye was more sensitive than available instruments and the mathematics of Kubelka-Munk too complex for routine calculations.

Old practices continue through much of the coatings industry, but two developments make quantitative evaluation of pigments now appropriate: optical instruments have become more sensitive and reliable than the eye and the least of computers calculates results on the spot.

Light scattering and light absorption by paint films, i.e., their hiding and color, can be quantified independently from reflectance measurements of thin** films drawn over black and white substrates, combined with determinations of film thickness or film weight and composition.

This article is taken, in part, from Braun, J.H., "Introduction to Pigments," *Federation Series on Coatings Technology*, published by Federation of Societies for Coatings Technology, Blue Bell, PA 1993.

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¹Rankings are statements that express that "A" performs better than "B," "B" better than "C," etc., but that do not quantify by telling how much better "A" is than "B."

** The film must be thin enough to show a measurable contrast between the reflectances of the drawdown over the white and black portions of the substrate.



Photo courtesy of Sun Chemical Co.

With spectrophotometers, reflectances can be measured for any specific and narrow waveband. By measuring, waveband by waveband across the spectrum of visible light, applicability of hiding power measurements is extended from black and white to color. Paints of different hues can be compared and results be expressed separately for white and color pigment performance.

Tinting strength tests measure the relative light scattering of a white pigment by overwhelming the intrinsic absorptions of binder and pigment by addition of colorant. The same test principle is used to measure the color strength of a color pigment.

Optical effects of combined light scattering and absorption by homogeneous thin films are quantified by the Kubelka-Munk model.

Pigment Strength

The state-of-the-art cannot predict optical performance from physical characterization of the pigment alone. Evaluation is generally based on simulation of commercial applications; science is involved in only a few tests. Hiding power and color strength are measured on drawdowns of practical paints but evaluation of results can involve sophisticated concepts of optics.

1. *Contrast Ratio*: Contrast ratio is a measurement of the hiding of a paint without distinction between contributions from light scattering and absorption. By contrast ratio, a dirty white pigment of low brightness will seem better than a purer, high brightness counterpart of equal scattering power.

For evaluation, a paint is made and drawn down over a black and white substrate at a film thickness of incomplete hiding. Reflectances are measured separately over the black and the white background. The result is expressed as the ratio of reflectance over black divided by the reflectance over white:

$$\text{Contrast Ratio} = \text{Reflectance}_{(\text{black})} / \text{Reflectance}_{(\text{white})}$$

Under standardized conditions of pigment concentration and of film thickness, only two measurements of reflectance are needed.

With increasing hiding or film thickness, contrast ratios approach the value of "one" and sensitivity of the measure declines to zero. For paints that hide well, differences in contrast ratios become too small to be significant or paint films must be drawn too thin to be reproducible.

Film thickness is controlled by the application blade. Wet film thickness is one half blade clearance because film adheres to both blade and substrate and is sheared in the middle if paint flow is near Newtonian. The thicknesses of two paint films applied by the same blade and the same procedure can differ if one paint flows better than the other.

Table 1—Scattering and Absorption Characteristics of Pigments

Pigment	Scattering Coefficient		Absorption Coefficient	
	Value	Wavelength Dependent	Value	Wavelength Dependent
White	High	No	Zero	No
Black	Zero	No	High	No
Color				
Transparent	Zero	No	High to Zero	Yes
Opaque	High	Yes	High to Zero	Yes

2. *Tinting Strength*: Tinting strength measurements are used to measure light scattering of white pigments (independent of their absorption color) and color strength of color pigments (independent of their scattering characteristics). Results are based on comparisons of relative weights of pigments required for equal reflectances of experimental and standard paints. The method cannot separate absorption from scattering of light.

For evaluation of white pigments, a controlled amount of color pigment is added to provide absorption. For evaluation of color pigment, a controlled amount of white pigment overwhelms the effects of the intrinsic scattering of the color pigment.

Measurement is based on equal reflectance, unequal weights of standard and experimental pigment:

$$\text{Reflectance}_{(\text{exptl})} = \text{Reflectance}_{(\text{std})}$$

and:

$$\text{for colors: } (K/S)_{\text{exptl}} = (K/S)_{\text{std}} \times \text{Weight}_{\text{std}} / \text{Weight}_{\text{exptl}}$$

$$\text{for whites: } (S/K)_{\text{exptl}} = (S/K)_{\text{std}} \times \text{Weight}_{\text{std}} / \text{Weight}_{\text{exptl}}$$

where K = absorption coefficient of the pigment, i.e., the quantitative description of its absorption strength, almost zero for white pigments, large and color dependent for color pigments; and

S = scattering coefficient of the pigment, i.e., the quantitative description of its scattering power, almost zero for transparent color pigments, non-zero for opaque color pigments and high for white pigments (See Table 1).

Weight of the experimental pigment is adjusted to match the reflectance of the standard at "infinite" film thickness.* Small differences in tinting strength can be accommodated without weight adjustments by calculating relative reflectance differences.

Side-by-side tinting strength drawdowns can be used for comparisons and measurements of hue and chroma of color pigments and for undertone determinations of white pigments.

3. *Kubelka-Munk Measurements*[†]: The Kubelka-Munk theory (Figure 1) allows determination of pigment strength independently for both scattering and absorption. The model accounts for reflection and transmission of light by a colorant film from upward and downward fluxes through a thin elementary layer. Stipulated are uniform distribution of the colorant and diffuse lighting. Although neither requirement can be met in practice, the results of calculations are excellent.

The model is simple but the equations that describe it are complicated. They yield two coefficients: Absorption Coefficient K and Scattering Coefficient S. Both characterize the colorant film but can be assigned directly to the pigments in the film. Frequently encountered in Kubelka-Munk context are two values:

- K/S, ratio of absorption (K) and scattering (S) coefficients, a measure of the scattering/absorption balance of a pigment or film; and
- SX, product of scattering coefficient (S) and film thickness (X), a measure of a film's scattering contribution to hiding.

Measurements can be done in reflectance or transmission modes. One film thickness and four reflectance measurements—reflectances of white background, of black back-

*The film must be thick enough, so that further increases in thickness do not affect reflectance.

[†] Judd, D.B. and Wyszecki, G., *Color in Business, Science and Industry*. 3rd Ed., John Wiley & Sons, New York, 1975.

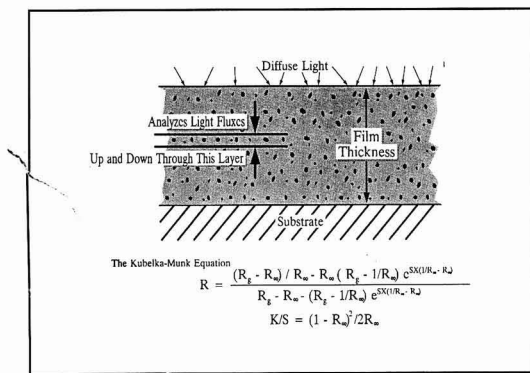


Figure 1—Kubelka-Munk model of light flux. Describes the fluxes of diffuse light within a turbid medium used in measurements of hiding opacity and color strength

ground, film over white and film over black—or one reflectance and one transmission measurement are required for independent evaluation of scattering and absorption.

Absorption and scattering coefficients characterize the optical performance of a pigment. For each color pigment the coefficients range from near zero to large depending on wavelength. They must be measured and applied separately for each wavelength band.

Several other models of the performance of colorant films have been proposed. Many are more complex than Kubelka-Munk without offering commensurately greater insight. None are used widely.

DURABILITY

Color pigments are destroyed by the direct interaction with UV light. Some quite rapidly, some very slowly, but all fade eventually. White pigments, by contrast, are stable but, in the presence of water and oxygen, catalyze the breakdown of paint films. Thus, color pigments are tested for fade, whites for film degradation.

Often, fade occurs and can be tested faster and in less complex settings while film degradation must include cyclic control of moisture and light. Thus the decorative performance of pigments is easier to test than their contribution to the protective function of paint films.

Color Pigments

The durability testing of color pigments is fairly simple, reasonably reliable, but not quantitative. Paints are made with experimental and standard pigments. Panels are painted and exposed to sunlight, artificial sunlight, or UV light, side by side, portions of the panel covered by a flap. After suitable periods, several hundred hours UV or a few months outdoors, the panels are compared: exposed versus unexposed and experimental versus standard.

The rankings that can be derived from the comparisons are, of course, qualitative but because performance differences between pigments tend to be very large, conclusions based on rankings are reasonably reliable. Unfortunately, problems can arise where they matter most: Masstones of durable pigments undergo little detectable change even after long exposures. Intrinsic fade resistance may have to be established by the testing of tints.

Coatings

Testing the degradation of paint films is a complex matter. Several chemical reactants are involved: polymer,

TiO₂, water, and oxygen. Cycling of light and darkness, condensation and dryness matters. UV light sources are not stable, their intensity decays over periods not much longer than exposure experiments. UV fluxes are difficult to measure.

Problems of measurement add to the experimental difficulties. Change affects different performance characteristics—gloss, chalk, fade, etc.—at different rates. Failure is gradual rather than abrupt. Finally, testing is far too expensive to encourage the extensive replication that statistical reliability would dictate.

Instead of quantitative durability measures, the industry accepts ratings based on simulations of natural exposures. Ideally, durability would be measured in terms of times and activities:

“Durability” = f (time of exposure, reactivity of components, etc.)

Such a function would provide time factors of durability. With quantitative rather than comparative durability data, results from different sources could be compared and degradation processes could be modeled. Unfortunately, “durability” cannot be measured as a direct function of time because the degradation of a paint film involves multiple chains of events with links that are not time-dependent and others that are specific to certain systems.

Usually paints are made of experimental and standard pigments, panels are painted and exposed either in cabinets for accelerated exposure or outdoors at climates that combine high humidity, high UV, and long periods of sunshine. Selected manifestations of degradation are measured repeatedly over long periods of time. Eventually measurements are analyzed and results of “experimentals” and “standards” compared and ranked. Exposure results are not, and cannot be, rigorously quantitative. Far too often statistical validation is lacking, reproducibility is overestimated, and the value of conclusions overrated.

The simulation of real world conditions seems realistic and credible until one examines the shortcuts that must be taken because durable paints exposed under relevant conditions last longer than business can wait for results:

- Durable pigments are evaluated in non-durable vehicles and good vehicles with poor pigments.
- Exposures are conducted at environmental extremes.
- Outdoor exposures are not quite natural but accelerated by choice of location—desert, tropical and industrial—and sometimes by sun tracking of the panels.

Geographic, meteorological and seasonal variations, and exposure starts in the spring or fall add further complications.

CHEMICAL AND MECHANICAL PERFORMANCE

The chemical and mechanical properties of paint films are determined by the characteristics of the continuous phase of the composite, the binder. The characteristics of the discontinuous phases, the pigment mix, contribute little to performance except for chemical failures caused by incompatibilities of specific pigments with specific environmental agents.

Carbonate extenders are attacked and dissolved by acids, lead pigments discolored by sulfide emissions. Pigments and extenders, contaminated with soluble salts, can enhance susceptibility of paint films to blushing, a discoloration caused by moisture.

We leave it to polymer and to paint experts to discuss the subject in greater detail.

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PUBLICATIONS

- A **Complimentary subscription** to the *Journal of Coatings Technology* is included with your membership dues. The JCT, published monthly, is respected around the world for the quality of its technical information. Each issue features papers on the cutting edge of technology, as well as information covering regulatory updates, people in the news, new products, etc.
- The Year Book, the **Who's Who in the Coatings Industry** provides names, addresses, phone and fax numbers of over 7,400 coatings professionals. Included with dues, the spiral-bound desk reference lists FSCT's 27 Constituent Societies and Affiliated members. (a \$150 value)
- FSCT's reference materials including the *Coatings Encyclopedic Dictionary*, *SciQuest*, and the *Series on Coatings Technology* are available to members at discounted prices - you can **save up to 25%**.

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JCT Mixing and Dispersing Suppliers Guide

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E-Mail: ajmixing@globalserve.net
A.B. (Bliss) Flower

A.P. Dataweigh Systems
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Suwanee, GA 30024
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Fax: (770) 932-4229
E-Mail: dataweigh@aol.com
Patrick Hetzel, Marketing Dir.

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Los Angeles, CA 90022
Phone: (213) 721-8994
Fax: (213) 721-1096
Jerry Flom, Authorized Rep.

Avestin Inc.
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Ottawa, Ont. K1G 3H9
Canada
Phone: (613) 234-7709

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Saginaw, MI 48601
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Greg Burns, Product Mgr.; Pete Giles, Sales Mgr.

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Barrington, IL 60010
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E-Mail: Barnant@mc.net

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Fax: (330) 633-1977
Dawn Roth, Sales

Bergen Barrel & Drum Co.
43-45 O'Brien St.
Kearny, NJ 07032
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Fax: (630) 238-9567
Kurt Buehrer, Project Mgr.

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Fax: (315) 253-3099
E-Mail: bladeshop@relex.com
Mitch Meyer, President

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Steelcraft Industries Ltd.
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Fax: (616) 639-2507
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Randolph C. Grieves, Kquality Equip. Co.

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Mike Lento, President; Robert Bruno, V.P.
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1001 E.W. T. Harris Blvd., Ste. P313
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Joseph E. Lesnfsky, President

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Industrial Marketing Mgr.

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WESTERN EQUIPMENT COMPANY
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Oakland, CA 94621
Phone: (510) 638-2774
Fax: (510) 632-5928
Don Mazzone, General Mgr.; Irma
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**"Tell me, and I forget.
Teach me, and I may remember.
Involve me, and I learn."**

— Benjamin Franklin

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Dual Drive Coaxial Dispersers

SCHOLD MACHINE CO.

Schold dual drive, dual motor, VHLS coaxial dispersers are designed for mixing and dispersing products with high viscosities in excess of 1,000,000 C.P.S. These dispersers combines a slow-speed, high-torque blade with a high-speed, high-shear blade in a coaxial position. The nominal speed range of the slow-speed blade is 20 to 155 RPM, while the range of the high-speed blade is 400 to 2,000 RPM. Product range capabilities include inks, caulks, flush pigments, paints, dyestuffs, epoxies, texturizing compounds, putties, adhesives, and resins.

Circle No. 59 on Reader Service Card

Gear Bung Entering Mixers

U.S. BEST, INC.

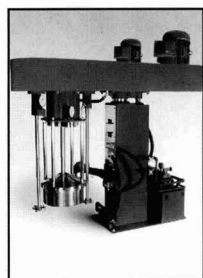


A catalog available from U.S. Best, Inc., features gear bung entering mixers for mixing in closed drums and tanks. These reduced mixers were designed for mixing extra thick products through the 2 in. bung of a standard 55-gallon closed head drum. TEFC, EP, air, and variable speed electric are standard equipment. These products use a 4 in. folding impeller with up to four impellers depending on the model selected.

Circle No. 60 on Reader Service Card

Araki Ring Mill

PREMIER MILL



Premier Mill has announced the availability of a new ring mill designed for highly efficient dispersion applications. Called the Araki Ring Mill, the new product offers mixing and dispersing in a single tank. Other features include: a closed bottom on the unit's media vessel, separate variable speed drives and high vane disperser blades. In addition, vortex action and centrifugal force are the only forces at work within the media vessel. The dispersion blades are mounted on independent shafts.

Circle No. 61 on Reader Service Card

DCP-Megaflow C

DRAISWERKE, INC.

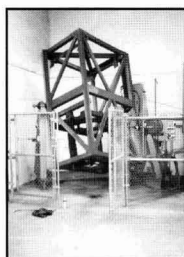


The DCP-Megaflow C was developed by Draiswerke, Inc., for high flow rate grinding and fast recirculation grinding. This product is equipped with the following features: enhanced dynamic media separation for better product/media separation; super cooled mill system for heat sensitive products; and advanced grinding vessel and agitator design for improved grinding media turbulence.

Circle No. 62 on Reader Service Card

Tumbler Blender

FABRICATED METALS, INC.

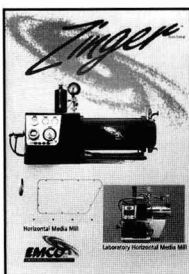


Fabricated Metals, Inc. introduces the Tumbler Blender for mixing both wet and dry products. Sizes range from 26 cu. ft. to 168 cu. ft. capacity. This product is made of stainless, carbon steel, or aluminum. Safety requirements include: IBC must be in position, fence must be closed, ignition key on control panel.

Circle No. 63 on Reader Service Card

Horizontal Media Mill

EMCO USA

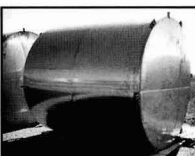


The new Zinger™ horizontal media mill from EMCO USA features proprietary design and technology. This product's radial rotor vanes draw media/product to the chamber center then mechanically force it outward producing less rotor/product slippage and using more shear energy in dispersion. Flow-direction control bars on the inside chamber surface rapidly decelerate and evenly disperse the media/product.

Circle No. 64 on Reader Service Card

Steel Mixing Tanks

WESTERN EQUIPMENT CO.

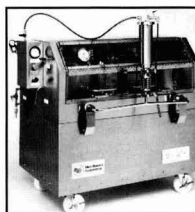


Western Equipment Co. provides 4,500 gallon stainless steel mixing tanks that are 316 SS, 8 ft. 8 in. X 10 in. tall, with a dome top and lifting eyes; tie down brackets; sanitary fittings in top (2-2 in. ft, 2-1 1/2 in. ft, 1-1 in. ft) 20 in. ft top hinged manway, oval-side manway, 2 in. ft discharge. Mixers are 1 1/2 HP, 40 rpm, 1 7/8 in. ft shafts with axial turbine blade. Tanks have never been used.

Circle No. 65 on Reader Service Card

M-140K High Pressure Electric-Hydraulic

MICROFLUIDICS INTERNATIONAL CORP.

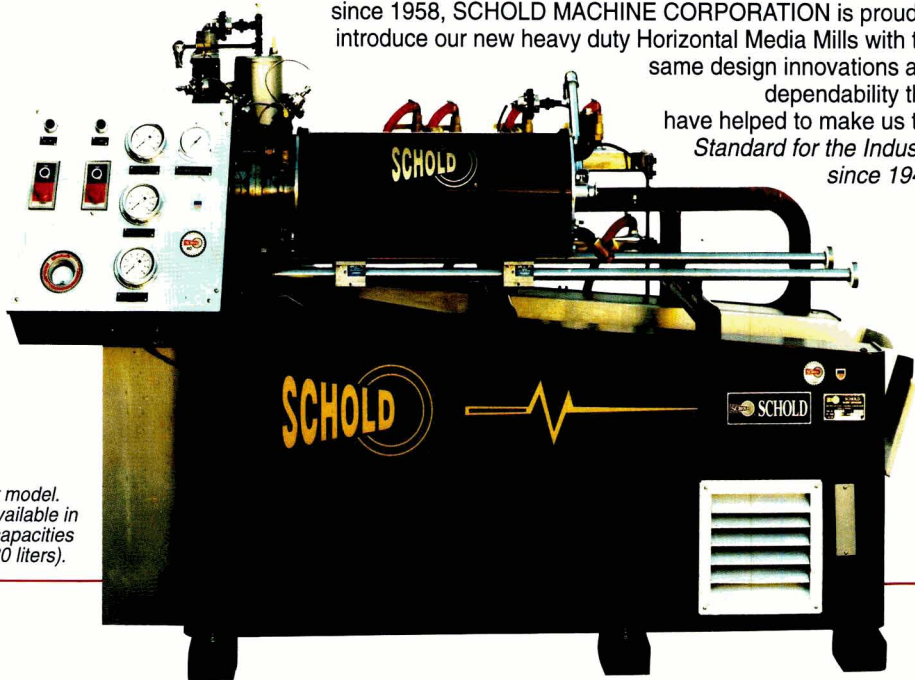


Designed to sustain prolonged high pressure demands and provide users with the opportunity to create new formulations and improve existing products, the M-140K features pressures from 8,000-40,000 psi. Available from Microfluidics, this product is mounted on locking casters for mobility. Other enhancements include: a diamond interaction chamber; and an aqueous plunger lubrication feature (seal quench).

Circle No. 66 on Reader Service Card

NEW FROM SCHOLD® HORIZONTAL MEDIA MILLS

The *originators of the shot mill* and your source for media mills since 1958, SCHOLD MACHINE CORPORATION is proud to introduce our new heavy duty Horizontal Media Mills with the same design innovations and dependability that have helped to make us the *Standard for the Industry since 1949.*



56 liter model.
Also available in
other capacities
(1/2-280 liters).

All Schold Horizontal Media Mills Come Complete With:

- Rotary Screen with Carbide Gap
- SS Alloy Discs
- Pressurized Shaft Seals
- Media Discharge Tray
- Zoned Chamber Cooling
- Sliding Chamber
- 10 Gallon Flushout Funnel Mounted to Variable Speed Gear Feed Pump
- Media Washout Trough
- Tool Kit
- All Safety Features

Safety Features

- Low Barrier Fluid Shutoff
- Low Barrier Fluid Pressure Shutoff
- High Temperature Shutoff
- High Pressure Shutoff
- Motor High Temperature Shutoff

ALL HORIZONTAL MEDIA MILLS ARE **NOT** ALIKE
Experience the Schold Difference



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Since 1949

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Midwest Facility

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Sales, Technical & Safety Hotline: 1-800-4MIXERS

Schold Research & Development, Inc.
Tel: 813-576-1132 • 708-458-3793

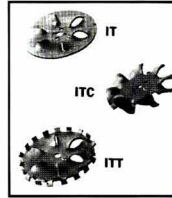
Multishear Mill
SILVERSON MACHINES INC.



A new high-speed mixer has been developed by Silverson Machines, Inc. The multishear mill consists of three or four sets of finely machined teeth running concentrically against three or four sets of stators. The multi-stage rotor/stator workheads provide intense high shear, with a three-stage machine performing over three million individual shearing actions per second and a four-stage machine with over five million per second.

Circle No. 67 on Reader Service Card

Industrial Mixing Equipment
CONN AND CO.



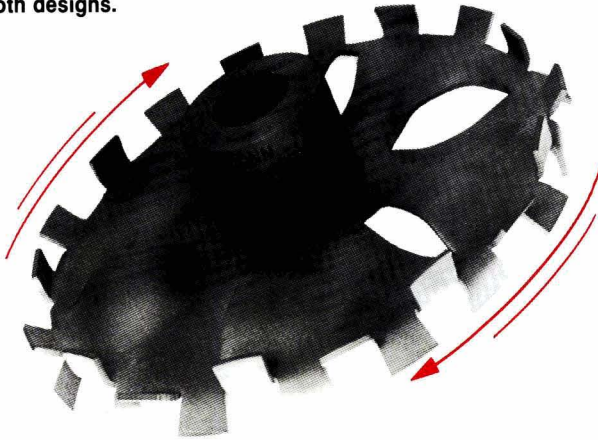
Conn and Co. designs and manufactures industrial mixing equipment. The company has introduced three patented blades under the tradename

Conn Blade®. The ITT style features a combination of louvers and teeth. The IT has louvers for gentle mixing for shear-sensitive materials. The ITC is an eight-vane, open style blade that proves more shear than the IT while allowing material flow. Conn Blades reportedly attain results in a shorter time with less heat generated.

Circle No. 68 on Reader Service Card

THE CONN BLADE®

Patented intensive type blending/dispersing blades with unique design features making a radical improvement over old saw tooth designs.



- ★ Most efficient and aggressive blending/dispersing blade available.
- ★ Provides proper combination of pumping action and shear/dispersion essential for fast and consistent results.
- ★ Built in pumping action for material turnover can cut processing time 30 to 40%.
- ★ Blades last much longer due to heavier gauge construction and shorter required running time.
- ★ Puts less heat into product.
- ★ Excellent for high or low speed and high or low viscosity.
- ★ Supplied with hubs or mounting holes required to retrofit and upgrade present equipment.
- ★ Pumping blades without teeth are available and are excellent for more gentle blending and agitation.

DESIGNERS AND MANUFACTURERS OF INDUSTRIAL MIXING EQUIPMENT

Since 1948
CONN AND CO.
"We Keep Things Mixed Up"

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Circle No. 142 on Reader Service Card

Jar Mill Machine

PAUL N. GARDNER CO., INC.

The Labmill 8000 Jar Mill Machine has been developed by Paul N. Gardner Co., Inc. The unit features silent operation with internal gear transmission, mill speed controlled by external potentiometer that adjusts power output voltage, durable unpainted welded steel case with chip and corrosion resistant black powder coating, and low power consumption during continuous operation.



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Concentric Shaft Disperser
BOWERS PROCESS EQUIPMENT INC.

Bowers Process Equipment has added a concentric disperser with a telescoping shaft to its line of mixers and dispersers. At any time during the process, while still maintaining vacuum and without interfering with any other function, the centrally located disperser shaft can be hydraulically raised or lowered to vary the mixing action or suit the batch depth. With this feature, one vessel can be used to efficiently mix everything from small starting batches to maximum tank capacity.

Circle No. 70 on Reader Service Card

BIRMINGHAM—OCTOBER

"B Hydroxyalkylamides"

Peter Brown, of Ciba, received a 25-year membership pin.

Tony Pledger, of EMS Chemie AG, discussed "THE USAGE OF B HYDROXY-ALKYLAMIDES IN DURABLE EXTERIOR POWDER COATINGS."

Mr. Pledger stated that the use of powder coatings is growing. In addition, the speaker described the function of TGIC. He said that it gives good properties but it is not considered environmentally friendly. The present classification is Xn but in 1998 it will be toxic. Of the alternatives, HAA shows the best properties and is virtually non-toxic.

Charging characteristics of HAA are suitable for Corona and Tribo application and storage stability is improved.

The outline of new HAA types were given. These show excellent durability outdoors thus opening up new applications. TGIC, however, is still better where industrial direct fired gas ovens are concerned.

In conclusion, the speaker emphasized the chemical advantage of HAA. Gas oven stability will be improved and the excellent weatherability will lead to new outlets for powder coatings.

TONY WALLINGTON, *Secretary*

BIRMINGHAM—NOVEMBER

"Metal Pretreatments"

The evening's technical presentation was delivered by Ron Catton, of Henkel Corp. He spoke on "METAL PRETREATMENTS."

According to Mr. Catton, environmental legislation has made metal pretreatment a more complicated process especially where effluent discharge and sludge disposal is concerned.

Iron phosphate is the most environmentally friendly but has a limited performance. Zinc phosphate can give very good results but accelerators such as nitrates can give disposal problems.

The speaker described other systems including polymer zirconium and titanium organics. He also said that better plant design is an option. More cooperation between the paint manufacturer and the pretreatment manufacturer would help.

Mr. Catton reiterated that systems that fail the health and safety requirement will not be viable.

TONY WALLINGTON, *Secretary*

BIRMINGHAM—DECEMBER

"Gloss Measurement"

"GLOSS MEASUREMENT" was presented by Keith Smith, Consultant.

Mr. Smith said that gloss is the first thing people notice in a paint finish. Any defects in the film are immediately apparent.

The measurement of gloss was defined in 1925 but the human eye sees other factors as regards to the paint finish, e.g., image clarity. Optical illusions can sometimes cause problems, hence, the necessity of a standard measurement instrument.

The various types of gloss measuring instruments were discussed. Mr. Smith noted that 60° and 20° angles are better able to give readings that take into account haziness.

A gloss measuring instrument should give reproducible results, gloss, haziness, and distinction of image, preferably with a software and memory facility.

TONY WALLINGTON, *Secretary*

BIRMINGHAM—JANUARY

"Automotive Styling"

Stephane Richaro, of Engelhard Corp., discussed "TRENDS IN AUTOMOTIVE STYLING IN EUROPE."

The current situation of pearlescent pigments in the automotive industry varies from place to place; for example, Japan prefers metallics.

According to Mr. Richaro, new products with improved flip flop effects have been developed, but there may be a delay of up to three years before they are available in Europe.

The speaker showed a series of panels with various effects. A substrate containing glass flakes gave a particularly striking effect.

Mr. Richaro said that the flip flop effect will be improved further.

TONY WALLINGTON, *Secretary*

JCT
JOURNAL OF COATINGS TECHNOLOGY

BIRMINGHAM—FEBRUARY

"Non-Impact (Digital) Imaging"

FSCT Secretary-Treasurer Gerry Gough, of ICI Packaging Group, presented Stan Ray with a 50-year membership pin.

K. Chater, of Akcros Chemicals America, received a 25-year membership pin.

D. Penrice was presented with an Honorary Life Membership.

The evening's presentation was delivered by Stuart Partridge. He discussed "THE IMPACT OF NON-IMPACT (DIGITAL) IMAGING."

According to Mr. Partridge, digital revolution has dramatically increased the speed of data transmission. Although 28,000 to 56,000 bits per second are used on telephone/modem systems, figures of 650 million bits per second are now achievable today and further advances will be made.

Digitally controlled thermal transfer, ink jet, ink spray, and electrostatic printers provide the opportunity to print computer designs.

Mr. Partridge stated that combining the new data transmission speeds with new printing techniques has enabled many objects to be printed quickly and comparatively cheaply. There are no printing plates to be prepared, etc. Using digital printing techniques can be more economic for printing small runs of an individual design, such as posters, carpets, ties, etc. With long runs of an individual design the older techniques would be more economic. Digital non-impact printing entails high capital plant cost and high cost of specialized inks but benefits from its flexibility.

It was stated that electrostatically printed images had to be laminated to produce scuff resistant images.

Sublimation dyes have been used on cloth to produce theater backdrops. A block of solid ink was shown.

TONY WALLINGTON, *Secretary*

CDIC—MARCH

"Natural vs. Accelerated Testing"

Nominating Committee Chair William Jelf, of Akzo Nobel Coatings Inc., reviewed the ballot for 1998-99 officers. Mr. Jelf asked for additional nomina-

tions; however, none were submitted. The nominations were closed and will be voted on in April.

Scholarship Committee Chair Andrew Noguiera, of Hunting Industrial Coatings, announced the Jeff Grossman, of Akzo Nobel Coatings Inc., is the recipient of the Lew Larson Scholarship.

The Executive Committee recommended that the Society donate \$500 to

CIEF in honor of Lew Larson, Ed Fasig, Ernie Mueller, and Herb Fenburr. The membership approved the recommendation unanimously.

The evening's technical speaker was Cleveland Society member Glenn J. Bebie, of Q-Panel Lab Products. Mr. Bebie discussed "NATURAL VERSUS ACCELERATED TESTING: WHAT IS THE BEST WAY?"

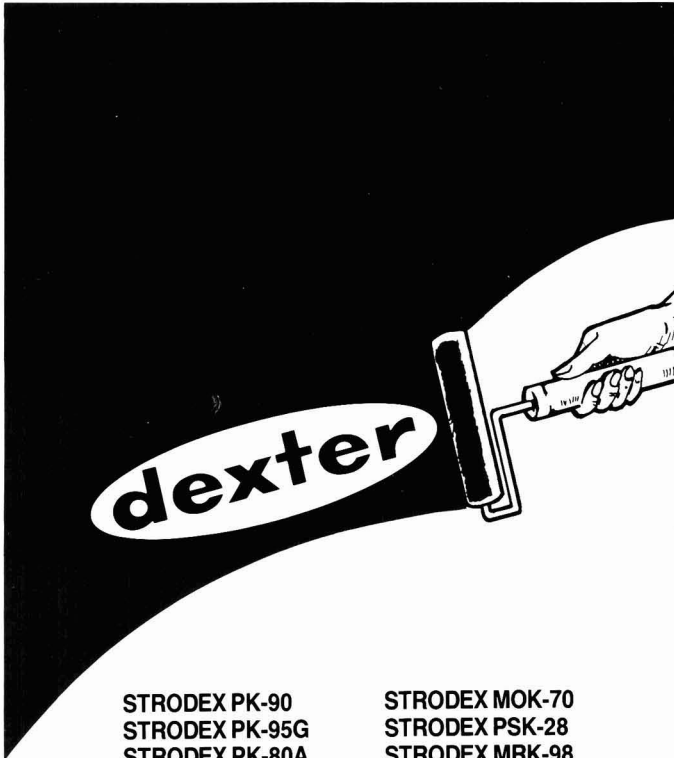
According to Mr. Bebie, ultraviolet energy, condensation, and temperature

are the three primary conditions that combine to attack a coating's appearance and longevity. Ultraviolet energy between 295 to 400 nm is the range of interest for coatings purposes because anything past the 295 nm cutoff is not natural. It has been stated that short wavelengths are more damaging than long wavelengths and that the relation between the sun angle and air mass is critical to severity of its effect. In addition, moisture should be considered in the form of condensation to a greater extent than rainfall. Higher temperatures translate to greater degradation.

Mr. Bebie stated that in outdoor exposure testing, the panels are angled to reproduce real-life effects as closely as possible. Forty-five degrees is the most common angle providing a representation of UV, wetness, and temperature, however, it is unrealistic. Five degrees, as specified to automotive is more realistic, since it closely simulates the varying angles of the actual application. Mr. Bebie said that 90° as applied to industrial maintenance scenarios is the least severe of the angles considering the resulting exposure effect of UV, wetness, and temperature.

The speaker said that horizontal exposure is used for roofing material applications and is understandably harsh considering the puddle effect which results. Other specific circumstances are implemented to determine their effect upon various applications. Under glass is used for instances such as art and textile in which shorter wavelengths are filtered out and little wet time is experienced. Under glass is combined with black box which is a GM automotive specification created in the 1970s. Such a combination would evaluate steering column and other interior automotive part performance. Backed applications are used to simulate construction type applications where temperature swings from heated to cooled are common. Mr. Bebie noted an interesting inconsistency concerning testing of panels on racks in that panels on the outer areas of the rack can be cooled by the wind where as the panels located on the inner areas are not cooled thus skewing the temperature variable.

The speaker stated that laboratory testing is done by three means of screening: carbon arc, xenon arc, and QUV. Carbon arc is a Japanese specification growing into greater obsolescence. Xenon arc is a German-developed method utilizing the full spectrum from 295 to 700 nm. The Boro/Boro filter can be used to more closely simulate sunlight. The Quartz/Boro filter goes below the actual wavelength range which is disadvantageous when considering true life coating applications. Wetness variables



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can also be added to the testing configuration. Variables with the Xenon method do develop with aging of the apparatus and its light source. QUV utilizes eight lamps at a two-inch distance from the exposure. Condensation simulation is created in the off light cycles. The QUV provides the best simulation of UV light in an accelerated tester for the shorter wavelengths. Wavelengths of 400 nm and more are not well covered by the QUV. An irradiance control microprocessor enables the machine to lock in appropriate stable irradiance while adding longevity to the lamps. Spray, in addition to condensation, variables can also be added to the testing configuration.

Natural testing is more realistic, easier, inexpensive, and recognized as an international benchmark, noted Mr. Bebie. Accelerated laboratory testing provides faster results, reproducibility, and standardization. Ultimately, natural testing is the best means by which to test, but, real world demands sometimes require speed to be considered over realism. The best course of action is to use accelerated testing for more immediate results to then be compared with real world results when finalized. All things taken into consideration leads to the conclusion that both natural and accelerated weathering are advised.

BRIAN MARZANO, *Secretary*

CLEVELAND—FEBRUARY

"New Waterborne Phenox Resins"

President James Currie of Jamestown Paint Co., noted that bylaws changes will be posted in the monthly flyer. He asked the members to read these changes since they will be voted on in March.

Technical Committee Chair Ben Carlozzo, of DCA Coatings, presented FSCT Certificates of Merit to the members of the Committee in recognition of the First Place Award for their presentation at the FSCT Annual Meeting in Atlanta, GA, of "Temperature Dependence on the Rheological Behavior of Modified Acrylic Latex Coatings." The following members were acknowledged for their efforts: Ben Carlozzo; Chris Harding, Coatings Research Group, Inc.; Brian Mysza, The Sherwin-Williams Co.; Russell Raymond, Q-Panel Lab Products; John Weaver, Case Western Reserve University; Charles Williams, The Lubrizol Corp.; Jeff Andrews, Montana Products; Mark DeLorenzo; Steve Grossman, Q-Panel Lab Products; Fred Anwari, BFGoodrich; Wally Stipkovich, Coatings Research Group Inc.; Juan Jarufe, X-I-M

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Martin's West, Baltimore, MD). STEPHANIE ROTHENBERG, Thomley Co., 1500 E. Newport Pike, Ste. 204, Wilmington, DE 19804.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). GRAHAME W. FOWKES, Technvelopments Co., 14 Wells Close, Chippenham, Wilts. SN14 0GD, England.

CDIC (Second Monday—Location alternates between Cincinnati, Columbus, Dayton, and Indianapolis). BRIAN P. MARZANO, Sun Chemical Corp., 5020 Spring Grove Ave., Cincinnati, OH 45232.

CHICAGO (First Monday—The Ambassador Restaurant, Elmhurst, IL). SUSAN A. SIMPSON, Chemecept Services, 2 South 902 Heritage Glen Ct., Batavia, IL 60510-5100.

CLEVELAND (Third Tuesday—Monthly meeting site to TBA). PATRICIA WAGLE, The Flood Co., 1212 Barlow Rd., Hudson, OH 44236.

DALLAS (Second Thursday following first Wednesday—Dallas Medallion Hotel, Dallas, TX). JOSEPH HILBUN, The Sherwin-Williams Co., 2802 W. Miller Rd., Garland, TX 75041.

DETROIT (Second Tuesday—meeting sites vary). NAOMI SUSS, PPG Industries, Inc., 5875 New King Ct., P.O. Box 3510, Troy, MI 48007.

GOLDEN GATE (Monday before third Wednesday—alternates between Francisco's in Oakland, CA, and Bertolucci's in S. San Francisco, CA). TIMOTHY G. SPECHT, Flecto Co., 1000 45th St., Oakland, CA 94608.

HOUSTON (Second Wednesday—Medallion Hotel, Houston, TX). STEVEN RAGSDALE, Intercoastal Paint, P.O. Box 38114-433, Houston, TX 77238.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). THOMAS HILTON, Weskem-Hall, Inc. 1424 Atlantic Ave., N. Kansas City, MO 64116.

LOS ANGELES (Second Wednesday—Maggie's Pub, Santa Fe Springs, CA). DARIN EVERHART, Behr Process Corp., 3400 W. Barry St., Santa Ana, CA 92704.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). CAROL WINSLOW RAPP, Dar-Tech, Inc., 101 Glenmill Rd., New Albany, IN 47150.

MEXICO (Every fifteen days—Gabriel Mancera, Mexico City, Mexico). MANUEL MAESTRO NAVARRO, DuPont, S.A. de C.V., Km. 9.5 Via Dr. Gustavo Baz, Col. Barrientos, 54110 Tlalnepanlta, Edo de Mexico, Mexico.

MONTREAL (First Wednesday—Restaurant Le Biffh que, St. Laurent, Quebec). ROBERT BENOIT, Kronos Canada Inc., 3390 Marie Victorin, Varennes, Que., J3X 1T4 Canada.

NEW ENGLAND (Third Thursday—Best Western TLC, Waltham, MA). GARY SMALL, Zeneca Resins, 730 Main St., Wilmington, MA 01887-3366.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). E. ROBERT CARDIN, Rohm and Haas Co., 16 Meadowview Dr., Colts Neck, NJ 07722.

NORTHWESTERN (Second Tuesday—Jax Cafe, Minneapolis, MN). ROBIN L. NORCUTT, George C. Brandt, Inc., 2975 Long Lake Rd., St. Paul, MN 55113.

PACIFIC NORTHWEST (PORTLAND SECTION—Tuesday before third Wednesday—Saylor's Old Country Kitchen; SEATTLE SECTION—Third Wednesday—All City Diner; VANCOUVER SECTION—Thursday after third Wednesday—Abercorn Inn, Richmond, B.C.). KELVIN HUGET, Imasco Minerals, Inc., 19287 98A Ave., Surrey, B.C. V4N 4C8, Canada.

PHILADELPHIA (Second Thursday—Doubletree Guest Suites, Plymouth Meeting, PA). NEIL R. SHEARER, Andek Corp., P.O. Box 392, Moorestown, NJ 08057.

PIEDMONT (Third Wednesday—Woman's Club of High Point, High Point, NC). RANDOLPH G. COX, Akzo Nobel Coatings Inc., 1431 Progress St., P.O. Box 2124, High Point, NC 27261.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). JOHN GILLEN, J.M. Gillen Co./Van Horn, Metz & Co., 681 Millers Run Rd., P.O. Box 428, Cuddy, PA 15031.

ROCKY MOUNTAIN (Monday following first Wednesday—DelMonico Hall, Denver, CO). GEORGETTE SIPARSKY, TDA Research, 12345 W. 52nd Ave., Wheat Ridge, CO 80033.

ST. LOUIS (Third Tuesday—The Salad Bowl Restaurant, St. Louis, MO). NICHOLAS HALL, U.S. Paint Corp., 831 S. 21st St., St. Louis, MO 63103.

SOUTHERN (GULF COAST SECTION—third Tuesday; CENTRAL FLORIDA SECTION—third Thursday after first Monday; ATLANTA SECTION—third Thursday; MEMPHIS SECTION—bi-monthly on second Tuesday; and MIAMI SECTION—Tuesday prior to Central Florida Section). DALE KENKNIGHT, Akzo Nobel Coatings Inc., 6369 Old Peachtree Rd., Norcross, GA 30071-1780.

TORONTO (Second Monday—Speranza Restaurant & Banquet Hall Convention Centre, Brampton, Ont., Canada). FRANS GROOTVELD, Ciba Pigments, 6860 Century Ave., Mississauga, Ont., L5N 5N3, Canada.

Western New York—Marko Markoff, 182 Farmingdale Rd., Cheektowaga, NY 14225.

Products, Inc.; Brian Scarry; Connie Williams, The Lubrizol Corp.; Guy Wilson, The Sherwin-Williams Co.; Liz Blanck-schaen; and Roy Glover, The Mahoning Paint Corp.

Larry Waskowski, of Phenoxy Specialties, spoke on "NEW WATERBORNE PHENOXY RESINS."

Mr. Waskowski stated that phenoxy describes a polymer. The name was coined by Union Carbide in the 1960s, when they first developed phenoxy resins. Phenoxy resins can be described as a family member of a polyhydroxyether. The speaker stated that it contains an ether linkage, which is fundamental to the polymer, and a hydroxy group—essentially an epoxy resin backbone. Phenoxy resins share many of the same properties as epoxy resins due to the aromatic linkage, which provides resistance to hydrolysis, chemical resistance, toughness and hardness, and to the hydroxy group, which provides adhesion to metal substrates. They differ from epoxies due to n which results in a high molecular weight polymer.

Mr. Waskowski stated that in solid grade phenoxy resins, since n is large, the end groups become trivial. No epoxide remains and the end groups are actually alpha hydroxyls, alpha glycols, or aromatic hydroxyls. These resins are amorphous, have a T_g of 98°C, have thermoplastic properties and are actually sold as a plastic. They are tough and ductile, and form many polymer alloys. Experimental work is currently being carried out where the phenoxy is being used in film lamination. Here it is being used as a protective coating, replacing a solvent-borne coating. Phenoxyes are also being used as sealable film due to the excellent oxygen barrier properties they exhibit.

Solution phenoxyes, when compared to epoxies, exhibit very high impact strength. They are typically used as zinc rich metal primers and as clear coatings for containers and drum liners. They can be easily crosslinked with isocyanates, ureas, melamines, and phenolics at the hydroxyl sites. Since the hydroxyl sites are numerous it allows one to index very well on crosslinkers. These resins exhibit excellent adhesion, hardness with flexibility, impact resistance, and water and chemical resistance. The major drawback is the high viscosity which necessitates using them in low solids systems. Reducing to a usable solids level accounts for the high VOCs of these solution phenoxyes. Since they must be reduced to such a degree it only made sense to focus on developing water-based phenoxyes to lower not only the cost but also the VOC level.

Current water-based versions, some of which are commercially available and

others which are being developed, are typically surfactant free, anionically stabilized by tacking on a carbonyl group, pH sensitive, exhibit non-Newtonian rheological properties, but do contain some organic solvents as coalescents. They are available in a range of particle sizes and are primarily designed for bake applications. The possibility exists for some room temperature applications by mixing with a lower T_g resin to obtain room temperature cure.

The speaker stated that current formulation work includes DTM thermoset enamels, baked at 150°C and crosslinked with blocked isocyanates, phenolics, or melamines. When baking at that temperature the crosslinker can be used at 8-15 parts per hundred parts resin, which is under index. They can be baked without crosslinkers and still obtain some of the same properties but temperatures must be above 172°C.

In low bake enamels, around 90-120°C, the high amino content melamines work very well as crosslinkers. At these temperatures some performance over certain plastics can be achieved.

Additional formulation latitude is available by blending the water-based phenoxy with other water-based resins such as: low molecular weight anionically stabilized acrylics, urethanes, epoxy esters, and alkyds. The water-based phenolics are generally compatible with these resins which allows latitude in controlling for cost. Using these resins at 20 phr in a thermoset enamel helped the economics of the system without adversely affecting the performance properties. Conversely, adding the phenoxy at 20 phr to the base resin did not improve the performance properties of the base resin.

Future work focuses on trying to realize the water-based phenoxyes in air dry coatings. Initial trials indicate that the T_g is still too high causing the reactions to be sluggish. Focus may be on providing new phenoxyes with lower T_g to correct the problem without effecting performance.

PATRICIA WAGLE, *Secretary*

KANSAS CITY—FEBRUARY

"Crystalline Silica Hazard"

President Randy Ehmer, of Walsh & Associates, Inc., announced that the Joint Meeting of the Kansas City and St. Louis Societies will be held on June 5-6, at Lake of the Ozarks, MO.

Kyle Frakes, of Tnemec Co., Inc., demonstrated the Society's web page: www.kcsc.org. Mr. Frakes displayed the

computer screen and mechanics of the web site.

The evening's speaker, Sid Lauren, of CR Minerals, spoke on "AVOIDING THE CRYSTALLINE SILICA."

According to Mr. Lauren, in 1987 the IARC determined quartz containing crystalline silica to be a cancer causing agent, specifically silicosis. Diatomaceous earth with less than one percent crystalline content is considered amorphous. Historically, around World War II, fluxed diatomaceous crystalline silica became popular in low luster finishes for the U.S. Government. Its popularity has lingered and is considered an integral part of the industry. Mr. Lauren recommended a deposit of naturally occurring silica (diatomite) that does not need to be flux calcined. This would produce a formulated paint with no reportable silica.

TOM HILTON, *Secretary*

LOUISVILLE—FEBRUARY

Federation Officer Visit

FSCT Secretary-Treasurer Gerry Gough, of ICI Packaging Group, discussed some of the changes at the Federation level; most notably, the addition of the Arizona Society as the 27th Constituent Society. Mr. Gough stated that there is a need to strengthen the relationship with other worldwide professional groups. He also said that the FSCT needs to increase the number of educational offerings as well as membership offerings.

FSCT Executive Vice-President Robert F. Ziegler, recognized the dedicated efforts of Louisville Society members John Lanning, of Courtaulds Coatings Inc., and Ilona Duvall, of Red Spot Paint and Varnish Co.

William Leightner, of C.L. McGuire Co., announced that the Executive Committee selected three individuals to receive educational grants. The recipients are: Dana Phillips, of Color Corp., Chris King, of Courtaulds Coatings, and Monisha Barnhill, of Red Spot Paint and Varnish Co.

Chris Lockhart, of Reynolds Metals Co., announced that the deadline for Outstanding Service Award nominations is March 1, 1998.

Mr. Lockhart gave the first reading for the bylaws change to move the end of the fiscal year to June 30.

Ilona Duvall presented "PEARL AND ALUMINUM PIGMENTS IN WATERBORNE COAT-

INGS: WHAT VARIABLES DETERMINE OPTIMUM PERFORMANCE." The LSCT Technical Committee submitted this paper in the APJ/Voss Awards Competition during the 1997 FSCT Annual Meeting.

The rheological relationship and performance of a waterborne coating with pearl and aluminum pigments for plastic substrate application were evaluated. Aluminum and pearlescent pigments are specially treated for application in waterborne systems. Ms. Duvall said that rheology is one of the factors that strongly influences the efficiency of pearlescent and metallic pigment performance. Starting with a known satisfactory clearcoat formula, pigment levels are varied and the rheology profile measured. Automatic spray application equipment was used to apply the coatings to a plastic substrate to assure repeatable results. The color and gloss of each dried coating was measured. The results are the criteria for determining the relationship between pigment performance and the rheology of the coating system.

The speaker highlighted the aspects of rheology. Rheology is the study of deformation and flow of materials under force. Time and PVC (pigment volume concentration) of the formulation characterize the flow of materials. To determine the optimum rheological performance for aluminum and pearlescent pigments when applied to polycarbonate plastic substrates, several variations of the formula were evaluated to determine the effect of each component on the formulation. Various viscometers and rheometers were explained including the Zahn cup, Stormer viscometer, Brookfield viscometer, and a rheometer. Rotation flow and oscillatory flows were discussed and their measurements were defined as variables influencing rheology. A rheometer measures the amplitude and frequency of a sample.

Ms. Duvall explained differences of Newtonian and non-Newtonian shear curves and the influence of shear rates for each. Flow curves and viscosity curves are generated for increasing shear rate. The amplitude sweep was determined for the control clear coating. The flow determined that the structure changed under high shear rate. Next, aluminum was added to the clear formula at 0.8 lb per gallon and evaluated. This loading was determined by visual inspection of spray-outs. Pearlescent pigment in clear gave good visual appearance at 1.0 lb per gallon of pearl pigment. Good correlation of visual inspection and rheological properties was obtained for optimum loading levels. The rheological component drastically changes when one increases the aluminum to 1.5 lb per gallon.

In conclusion, aluminum and pearl pigments have an effect on rheology of a

coating. Pearl has a greater effect on viscosity when formulated beyond the 0.6 to 0.8 lb per gallon for combined aluminum and pearl.

CAROL WINSLOW-RAPP, *Secretary*

MONTREAL—APRIL

Spring Symposium

Nicole Riopelle, of Nesbitt Burns, addressed "THE INGREDIENTS OF A COMFORTABLE RETIREMENT."

Ms. Riopelle discussed the five essential steps of retirement planning. The steps are: (1) formulating a plan; (2) defining our objectives; (3) planning our retirement; (4) formulating and managing our investment program; and (5) choosing a consultant.

Jim Wise, of Nacan Product Ltd., covered "PAINT: FUTURE TRENDS (THE YEAR 2000)."

Mr. Wise stated that the paint industry has undergone numerous changes. Since many companies have merged, new products have been developed. According to Mr. Wise, product development is often influenced by the American and European markets, which frequently have to face greater pressure from governments and environmentalists.

In addition, the speaker discussed the different industrial and commercial technologies as well as the future trend of these markets, which will affect the Canadian industry in the future.

Jacques Charuest discussed "HOW TO MEASURE YOUR VULNERABILITY TO STRESS."

Mr. Charuest used an interactive approach to make the attendees aware of the internal and external stress factors. He presented day-to-day stress management techniques and gave advice for coping with stress.

Pierre Hadaya, of ESI Group spoke on "CHOOSING A COMPUTER AND ITS COMPONENTS."

Mr. Hadaya discussed the criteria to be considered when purchasing a computer. He also spoke on the software included in the purchase of a computer.

HORACE PHILIPP, *Society Representative*

NEW YORK—MARCH

FSCT Officer Visit

A moment of silence was observed in remembrance of William Singer, NYSCT Past-President (1977) and his wife Naomi.

FSCT Secretary-Treasurer Gerry Gough, of ICI Packaging Group, discussed FSCT's Strategic Plan. Mr. Gough noted that the Strategic Plan includes: (1) protecting and growing the current membership base; (2) improving FSCT's value to the members; and (3) changing the bylaws to facilitate membership and payment of dues.

FSCT Executive Vice President Robert F. Ziegler discussed the FSCT Strategic Plan further, stating that these changes have been worked on for over five years. With the implementation of the Plan, membership would be available at ICE. In addition, Mr. Ziegler noted that the JCT's *Regulatory Update* now features more global information.

The evening's speaker was Detroit Society member Rose Ryntz, of Visteon. She discussed "THERMOPLASTIC OLEFINS."

Dr. Ryntz highlighted a new plastic being used in the automotive industry: thermoplastic olefin (TPO). According to the speaker, it is relatively low in cost, low weight, and features excellent balance of mechanical and physical properties. It is a blend of polyolefin and rubber. The cohesive strength of a painted TPO substrate is often sacrificed under compressive loading/shearing conditions encountered in the field. It has been determined that the cohesive strength of the painted TPO substrate can be increased to satisfy field condition requirements through changes made in the TPO compounding as well as by variations made in topcoat chemistry.

According to Dr. Ryntz, the major problem with it is paintability. The paint has to diffuse through the top layer of polypropylene, swell the rubber component, and entangle with it to gain adhesion. Some of the problems encountered when painting include paint film thick-



At the March meeting of the New York Society, Robert Schroeder, of Elementis, presents Rose Ryntz, of Visteon, with a speakers plaque.

ness, crystallinity of the top layer of the film, and availability of the rubber. Usually a solvent-based primer is used to soften the rubber for adhesion. A pigmented midcoat is then applied, and finally, a clear acrylic urethane topcoat. Sometimes pretreatments are used prior to paint application. The cost of coating the TPO represents 65% of the total cost. Therefore, failure through application or paint choice can double this cost.

New testing methods had to be developed to minimize these costs and assure proper adhesion. One such test is to put a fluorescent dye into the paint to watch penetration. Increased penetration equals increased adhesion. Another is an adhesiometer test which shows how good the cohesive strength of the substrate is. The end result is that you cannot look at plastic or coating separately any longer due to constant changes in either which results in potential failures in the system.

E. ROBERT CARDIN, *Secretary*

NORTHWESTERN—MARCH

FSCT Officer Visit

A moment of silence was observed in remembrance of Donald P. Swanson, of Willard N. Swanson Co.

FSCT President Elect Forest Fleming, of Akzo Nobel Coatings Inc., presented an overview of ICE '97. In addition, Mr. Fleming explained the proposed changes at the Federation level. These changes include beginning the membership year on the same date for all Societies, streamlining the membership acceptance system, and adding two members to the Executive Committee.

FSCT Director of Educational Services Mike Bell highlighted future educational activities.

ROBIN NORCUTT, *Secretary*

PHILADELPHIA—MARCH

"The Use of Wax in Surface Coatings"

President-Elect Brian O'Connor, of E.W. Kaufmann Co., announced the officers nominated for 1998-99. They are: President-Elect—Neil Shearer, Andek Corp.; Secretary—A. Marshall Jones, Van Horn, Metz & Co., Inc.; Treasurer—Brian

Gilbert, E.W. Kaufmann Co.; Assistant Treasurer—Charles Pohan, M.A. Bruder & Sons, Inc.; Senior Member-At-Large—Sam Firestone, S.E. Firestone Associates, Inc.; Junior Member-At-Large—Mario Navarro, IPC/PyroTech Industries; Membership Committee Chair—Daniyel Firestone, S.E. Firestone Associates, Inc.; Technical Committee Chair—Pat Peterson, ARCO Chemical Co.; Educational Committee Chair—Rich Granata, Lehigh University; and Honorary Director—Don Fritz.

The first speaker of the evening was Randall Ocamb, of Innovative Motion Solutions. He discussed "REDUCING WORKERS' COMPENSATION COSTS AND INCREASING PRODUCTIVITY THROUGH ERGONOMICS."

Mr. Ocamb focused on materials handling products that solve ergonomic problems while increasing productivity. A hoist that uses vacuum to grasp a variety of loads was demonstrated in a video presentation. Handling techniques for five-gallon pails, 55-gallon drums, and various sizes and weight bags were also demonstrated.

The evening's second speaker was New York Society member Gregory Fedorchak, of Elementis Specialties. Mr. Fedorchak spoke on "THE USE OF WAX IN SURFACE COATINGS."

Mr. Fedorchak covered the history of the use of wax in coatings. He also defined what a wax is. Softening point and melt point are the primary characteristics considered in wax selection. Higher softening point waxes produce harder coatings. Softer waxes produce better slip to the coating, which protects against marring. In the 1950s low molecular polyethylene was the first synthetic used in coatings. According to the speaker, polyethylene wax replaced beeswax and other natural waxes that were mainly softer. Micronizing of waxes using cryogenic process produced waxes with a particle size that imparts the optimum mar resistance for the surface. Wax emulsions allow a better gloss to form but have less blocking and scuff resistance. Protrusion of wax particles beyond the surface of the coating produces a ball bearing-like effect that allows the lowest resistance to drag.

Mr. Fedorchak stated that waxes can also be used as flattening agents due to their light scattering effect. Particle size and distribution control the degree of flattening. The amount of wax present on the surface of the coating, as well as particle size and distribution, will affect recoatability. The dispersion of a wax in a solvent can affect its performance in a coating by altering its mobility in a coating during the drying and curing process.

NEIL SHEARER, *Secretary*

SCAM ALERT UPDATE

Thanks to everyone who sent copies of letters "proposing" millions of dollars from Nigeria in return for your bank account number. From the number received here it appears that the Nigerian suspects are spending more on postage and faxes than they may make in fraudulent dealings.

This just in . . .

If you get a call from someone identifying themselves as a phone technician who asks you to press 90# and then hang up in order to complete a test of the line—Don't do it! This is a scam originating from several jails and prisons. That code gives the "technician" access to your line, allowing them to make a long distance call, charged to your account. Ask for the caller's name and number and tell them you'll call back. Then call the phone company to report the incident.

BIRMINGHAM

Associate

Gregory, Brian J.—Tioxide Europe Ltd., Hartlepool.
Jenkins, Colin H.—Laporte Industries, Eversholt, Beds.

CDIC

Active

Patel, Ken—Bondo/Mar-Hyde Corp., Cincinnati, OH.

Associate

Andrews, Scott L.—Maroon Inc., Louisville, KY.

CLEVELAND

Active

Burford, Mark B.—Jamestown Paint Co., Jamestown, PA.
Fox, Paula G.—The Sherwin-Williams Co., Cleveland, OH.
Kurpiewski, Thomas—Lord Corp., Erie, PA.
Scranton, Robert J.—Morton Industrial, Orrville, OH.

Associate

Burk, Rody M.—Bakertown Container, Bakertown, PA.
Short, Christina K.—Ciba Specialty Chemicals, Cleveland Heights, OH.
Steffensen, Steven H.—Eastman Chemical Co., Columbus, OH.
Tamerlano, Nick A.—Henkel Corp., N. Royalton, OH.

DETROIT

Active

Houle, Mark L.—United Paint & Chemical Corp., Southfield, MI.
Lacasse, Robert A.—United Paint & Chemical Corp., Southfield.
Orvis, Eric C.—United Paint & Chemical Corp., Southfield.
Zhang, Jane—United Paint & Chemical Corp., Southfield.

Associate

Adams, Larry J.—Tenneco Automotive, Monroe, MI.
Henderson, Harper—PCI Magazine, Troy, MI.

KANSAS CITY

Associate

Caudle, Sarah B.—Peninsula Polymers, Kansas City, MO.
Robertson, Stuart L.—HCI Chemtech, Kansas City.

LOS ANGELES

Active

Ahonen, Rolf A.—Ameron International, Brea, CA.
Angenent, Conrad H.—Poly-Fiber Inc., Riverside, CA.
Barrie Jr., Edward—Dura Coat Products, Riverside.
Burdette, David L.—Surface Protection Ind., Inc., Los Angeles, CA.
Chattopadhyay, Ashok K.—Deft, Inc., Irvine, CA.
Cortez, William N.—Behr Process Corp., Santa Ana, CA.
Coulter, Kenneth W.—The Sherwin-Williams Co., Ontario, CA.
Hasbrouck, Mark S.—The Sherwin-Williams Co., Ontario.
Jerge, David C.—Frazee Industries, San Diego, CA.
Knight, Michael C.—Spraylat Corp., Los Angeles.
Kulnane, John C.—Behr Process Corp., Santa Ana.
Nguyen, Phuong—Coatings Resource Corp., Huntington Beach, CA.

Associate

Anderson, Vincent P.—E.T. Horn Co., La Mirada, CA.
Atkinson, Ken—Clariant Corp., Pasadena, CA.
Fleury, James—Superior Color & Chemical, Agoura Hills, CA.
Goldenbaum, Jon—Poly Fiber Inc., Riverside, CA.
Halpin, Steve M.—ChemCentral, Santa Fe Springs, CA.
Roney, Harold—ChemCentral, Santa Fe Springs.
Roque, Raquel A.—ChemCentral, Santa Fe Springs.
Sathre, Kevin D.—ChemCentral, Santa Fe Springs.
Swaggerty, David—MSC Specialty Films, Inc., San Diego, CA.
Wickersheim, Troy P.—ChemCentral, Santa Fe Springs.
Wool, Glenn—Ashland Chemical Co., Santa Ana, CA.

NEW ENGLAND

Active

Clement, Thomas—Parker Hannifin Corp., Woburn, MA.
Kennelly, J. Michael—Imtec Inc., Bellows Falls, VT.
Kuo, Lawrence L.—W.R. Grace & Co.-Conn., Cambridge, MA.
Trunillo, David H.—Zeneca Resins, Wilmington, MA.
Yee, Mei C.—Zeneca Resins, Wilmington.

Associate

Burke, Rose M.—SC Johnson Polymer, Media, PA.
Calder, Willie—Calder Machine, Florence, SC.
McCrudden, Charles E.—RSM Sales Inc., South Grafton, MA.

Nomelli, John F.—Van Horn, Metz & Co., Inc., New Hartford, CT.

NEW YORK

Active

Bicomong, Ricardo M.—Spraylat Corp., Mount Vernon, NY.
Chiu, Yu Ching—Spraylat Corp., Mount Vernon.
Danner, David A.—Rheox Inc., Hightstown, NJ.
Gutman, Israel C.—Dri-Print Foils Inc., Rahway, NJ.
Sadasivan, Sundar—Dri-Print Foils Inc., Rahway.
Weinstein, David A.—Akzo Nobel Coatings, Somerset, NJ.

Associate

Antonucci, Edward M.—Drew Industrial/Ashland, Boonton, NJ.
Rosner, Richard L.—Degussa Corp., Ridgefield Park, NJ.

PHILADELPHIA

Active

Patel, Malay A.—NSWCCD Philadelphia, Aston, PA.
Yang, Hui Shirley—Rhodia Inc., E. Windsor, NJ.

PIEDMONT

Active

Ellison, Michael L.—Reichhold Chemical Co., Research Triangle Park, NC.
Fisher, C. Edward Jr.—Warlick Paint Co., Statesville, NC.
Foster, Ronald L.—Morton International, Greenville, SC.
Kauppila, Lawrence J.—Associated Chemists, Orangeburg, SC.
Korb, Robert F.—Surgicot, Durham, NC.
Nelson, Douglas P.—The Valspar Corp., High Point, NC.
Wiley, Herbert—The Valspar Corp., High Point, NC.
Brannon, Jim B.—Rieke Corp., Lebanon, GA.

PITTSBURGH

Active

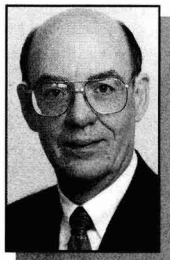
Brewster, Robert E.—Bob Brewster Painting, Black Lick, PA.
Sherman, Cynthia L.—PPG Industries Inc., Springdale, PA.

SOUTHERN

Active

Lowe, Darren E.—PRS Inc., Belle Chasse, LA.

People in the News



J.H. McBee

Akzo Nobel Resins, Louisville, KY, has announced the appointment of **James H. McBee** to Technical Service Manager. Mr. McBee's most recent responsibilities were as Research Chemist in the Technical Center. He is a member of the Louisville Society.

In addition, **Mohamad D. Shalati** has been promoted to the position of Technical Director for the North America Coatings Resins sub business unit, based in Louisville. Dr. Shalati's most recent technical function as a Scientist was with PPG Industries.

The M.F. Cachat Co., Cleveland, OH, has announced the addition of **Michael Barnes** as Technical Sales Representative. Mr. Barnes will provide specialty chemical technical sales and service for customers in northern Ohio.

Chicago Society member **Richard I. Tourgee** has also been added to the sales force as Technical Sales Representative. Mr. Tourgee will provide specialty chemical technical sales and service for customers in western Michigan, northern Indiana, and southern Illinois.

In addition, Pacific Northwest Society-Vancouver section member **Michael Griffin** will cover Massachusetts, New Hampshire, Vermont, eastern Connecticut, and northern New York as Technical Sales Representative for the company.

Susan Levko has accepted the position of Manager, Brand Development for Convenience Products, Fenton, MO. Ms. Levko will be responsible for new product development, market research, and brand identity for polyurethane foam insulation products in the consumer DIY and industrial industries, as well as the company's closure business.

Engelhard Corp., Iselin, NJ, has appointed **Anthony V. Parassio** as its new Director, Sales U.S./Canada for Specialty Pigments and Additives. He will oversee all sales activities in the U.S. and Canada for the group's color pigments, pearlescent pigments, and specialty kaolin and other minerals.

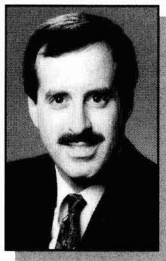


M.D. Shalati

Nina L. Loeffler has joined ANGUS Chemical Co., Buffalo Grove, IL, as Domestic Sales Department Representative for the Southeast Region. Ms. Loeffler, a member of the Kansas City Society, will represent the company's nitroparaffins, nitroparaffin derivatives, biocides, and buffer products to customers in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, and Oklahoma.

Claudia Ihrig has been named Regional Sales Representative within the Silicas and Chemical Catalysts Division of Degussa Corp., Ridgefield Park, NJ. Based out of the company's Technical Center in Akron, OH, Ms. Ihrig will be responsible for providing sales and support for the division's specialized products to the north central region of the U.S.

Millennium Inorganic Chemicals, Hunt Valley, MD, has appointed **Gary L. Cianfichi** to Global Business Director-Coatings. In this newly created position, Mr. Cianfichi will be responsible for the business direction of the company's paint and coatings business worldwide, including developing and managing the coatings product line and directing the regional marketing efforts to meet the company's market objectives. He is a member of the Baltimore Society.



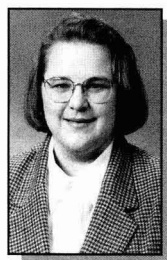
G.L. Cianfichi

PQ Corp., Valley Forge, PA, has promoted **John P. Votta** to National Account/Market Development Manager for its Britesorb® adsorbent gels product line. Mr. Votta will be responsible for the development and implementation of sales programs for strategic accounts as well as worldwide market development.

Raabe Corp., Menomonee Falls, WI, has promoted **Abby Brooks** and **Christopher Sonntag**. Ms. Brooks has been promoted to Marketing Project Manager, where she will be responsible for the planning and management of various marketing and advertising functions.

Mr. Sonntag has been promoted to Market Analyst. He will be responsible for identifying new market opportunities as well as sales lead qualification and trade show event planning.

Rebecca S. Ortiz has joined the Coatings and Adhesives group in the Emulsion Polymers business of The Dow Chemical Co., Midland, MI. In this position, Ms. Ortiz will concentrate on the development of latexes for use in industrial metal coatings. She is a member of the Dallas Society.



R.S. Ortiz

Howard E. Burke has been promoted to Commercial Manager/Europe for the coating additives business of The Lubrizol Corp., Wickliffe, OH. He will relocate to Lubrizol Coating Additives GmbH in Ritterhude, Germany. Mr. Burke will be responsible for leading the company's strategic international account effort, as well as running the European business from a sales and marketing standpoint.

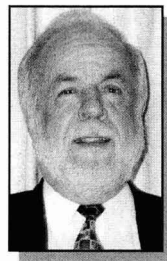
Charles Ross & Son Co., Hauppauge, NY, has named **Ed Bosch** Director of Product Development. Mr. Bosch will oversee new product development, as well as Ross' ongoing program to improve its existing product lines.

In other news, **Doug Cohen** has been appointed to the position of Vice President of Technical Services. Mr. Cohen will supervise several components of the company's development program.

Samuel Cabot Inc., Newburyport, MA, has promoted two executives. **John E. Schutz** was named Executive Vice President. He was formerly Vice President, Sales for the company. **John Anderson** was appointed Vice President, Manufacturing. He was previously with Osram SYLVANIA.

Crozier-Nelson Sales, Irving, TX, has promoted **Joseph Jedrusiak**, a Louisville Society member,

to Executive Vice President. Mr. Jedrusiak will be responsible for managing all branches of the company covering the states of Texas, Oklahoma, Louisiana, Arkansas, Mississippi, and Alabama.



J. Jedrusiak

Diversa Corp., San Diego, CA, has announced several promotions and the pending retirement of President **Donald Garaventi**. **Terrance Bruggeman**, current Chairman and CEO, has been elected and will assume the position of President upon Mr. Garaventi's retirement.

In addition, **Jay M. Short**, was elected Executive Vice President and Chief Technology Officer, and **Kathleen H. Van Sleen** was elected Senior Vice President and Chief Financial Officer.

Also, **Ron Swanson**, has been promoted to Director of Genomics and **Carolyn Erickson** was named Director of Intellectual Properties. **William Zondler** has been promoted to Director of Information Technology, **Thomas Christensen** has accepted the position of Controller, Assistant Secretary, and Assistant Treasurer; and **Keith Kretz**, was promoted to Principal Scientist.

Colorite Polymers, Ridgefield, NJ, has appointed **Andrew See** to the position of Sales Representative for Asia. Mr. See will be based in Singapore.

Emerson & Cuming Specialty Polymers, Lexington, MA, has named **Daniel E. Allen** to the position of Sales Manager, Americas. Mr. Allen was formerly the National Sales Manager for the Board Fabrication Division of Grace Specialty Polymers.

In other news, **Joseph P. McGonnell** was appointed Vice President and General Manager. Mr. McGonnell most recently served as Vice President, Sales and Marketing for Ablestik Laboratories.

Advanced Refractory Technologies, Inc., Buffalo, NY, has announced the addition of **Stephen Elliot** to its staff as Director of Business Development. In this new position, Mr. Elliott will evaluate growth opportunities through acquisitions, licensing of technology, joint ventures, and other strategies.

In addition, **Roger S. Storm** has joined the company as Vice President of Technology. Dr. Storm will be responsible for R&D activities in ceramic powders, structural and electronic ceramics, and diamond-like nanocomposite coatings.

Gwen Johnson has accepted the position of Sales Account Manager in the cosmetic ingredients division of Whittaker, Clark & Daniels, Inc., South Plainfield, NJ. Ms. Johnson will be responsible for the sale of the company's product lines to the cosmetics and fragrance industries in the Northeast region.

The U.S. Filter/Wheelabrator division, LaGrange, GA, has announced several promotions: **Mike Trotta** to Regional Business Manager for U.S. Filter/Abrasive Products; **Steve Klugherz** — Regional Sales Manager for the West Coast for U.S. Filter/Blastrac; **Steve London** — Regional Representative for U.S. Filter/Blastrac; **Tim Vickers** — Regional Business Manager for U.S. Filter/Abrasive Products; **Jim White** — Regional Sales and Service Representative for U.S. Filter/Wheelabrator; **Kelly Cook** — Materials Manager for U.S. Filter/Wheelabrator, and **Perry Elliott** — Regional Sales Manager for the Michigan and Northern Ohio sales area for U.S. Filter/Wheelabrator.

Obituary

William Singer, Inventor of Troysan® Polyphase® Dies at 72

William Singer, Past-President of the New York Society, passed away on March 2, 1998. He was 72 years old. Mr. Singer and his wife Naomi were overcome by carbon monoxide fumes and both died in their sleep (see accompanying article).

After earning a B.S. in Chemistry from the City University of New York, Mr. Singer performed graduate studies at the Polytechnic Institute of Brooklyn and research at New York University.

Mr. Singer joined Troy Corp. in 1959 as Chief, Coating Lab, and most recently served as Vice President of Research and Development. He had also been Chief Chemist at PurAll Paint Products and an Instructor in the School of General Studies at New York University.

The inventor of Troysan® Polyphase® non-metallic fungicides, Mr. Singer had been at the forefront of Troy's R&D efforts for over 30 years. He had a number of patents to his credit, including the first one dealing with iodopropargylalkyl carbamates, and had authored many award-winning technical papers.

He was a member of more than 20 professional and technical associations including the New York Society for Coatings Technology, American Chemical Society, and the American Association for the Advancement of Science.

Mr. Singer and his wife are survived by a son, Frank.

CO Detectors An Early Warning

A valued member of the coatings industry and his wife, William and Naomi Singer, died recently as a result of carbon monoxide poisoning. The JCT is reprinting the following information as a service to our readers, in the hopes that such tragedies will be prevented:

According to the July 1995 issue of *Consumer Reports*, about 200 people die annually of accidental poisoning from carbon monoxide (CO), a colorless, odorless gas, and another 5,000 are treated for it in hospital emergency rooms. The real toll is surely higher, since many of the symptoms—dizziness, nausea, vomiting, fatigue—are mistaken for the flu or another illness.

The culprit is usually a faulty fuel burning furnace, range, water heater, space heater, or wood stove (any combustible fuel will do, whether it be oil, natural gas, or propane). Proper maintenance of those appliances is the best way to reduce the risk of CO poisoning, but a device that monitors the air constantly is a crucial backup.

CO detectors resemble smoke detectors and shriek the same way when the alarm is tripped.

How CO Harms

Carbon monoxide inhibits the blood's capacity to carry oxygen. It combines with hemoglobin—the oxygen-carrying pigment in red blood cells—to form carboxyhemoglobin (COHb). The first symptoms of poisoning usually appear at about 15% COHb, although people with a heart condition can be harmed by even lower levels. A concentration of 50% COHb is often lethal.

Carbon monoxide can kill in minutes or hours.

Recommendations...

Consumer Reports recommends that your home has a fuel burning appliance or fireplace, you should have at least one CO detector, ideally in a hallway or sleeping area.

If your alarm goes off and you're experiencing any of the symptoms of carbon-monoxide poisoning, leave the house immediately and call your fuel company or the fire department. If the alarm goes off and you don't feel sick, shut off possible sources of CO, open the windows, and ventilate the house. Then, if the alarm goes off again, call a qualified technician to investigate right away.



Insulating Sealant

Touch 'N Seal[®], a one- and two- component polyurethane foam sealant, is being offered by Convenience Products. This foam system is for use with marine specialty applications including filling pontoons and structural voids to maintain buoyancy, hull repair, gas tank segregation, deck support, sound deadening, insulation, and air sealing. This sealant is packaged in disposable aerosol cans and cylinders covering 12 to 600 board feet.

Circle No. 30 on Reader Service Card

Concrete Sealer

Cortec Corp. has introduced a new surface-applied concrete sealer. The MCI-2021 preserves and protects by working with the chemistry of the concrete, penetrating up to one and a half inches. The resulting protective barrier reportedly inhibits the intrusion of chloride and carbonation, and protects against acid and alkali attack, while still allowing the concrete to breathe. The sealer can be used on concrete structures such as bridges, highways, streets, parking ramps, piers, pile, pillars, pipe, and utility poles.

Circle No. 31 on Reader Service Card



Capabilities Brochure

CVC Specialty Chemicals, Inc., has published a 16-page *Capabilities & Product Selection Guide*. This brochure includes a detailed product line listing of specialty epoxy resins, epoxy functional monomer modifiers, curing agents, and accelerators.

Circle No. 32 on Reader Service Card

Raw Material Guide

Creanova Inc. has published "(Meth-) Acrylic Monomers and Polymers," a guide that charts descriptions and applications for raw materials used in automotive products, industrial and maintenance paint, leather and textile coatings, dental products, emulsions, oil additives, paper processing products, sealers, coatings, contact lenses, and artificial fingernails. The eight-page brochure is ar-

anged in two sets of product description and application tables.

Circle No. 33 on Reader Service Card

Viscometer/Rheometer Catalog

A new 40-page color diamond anniversary catalog, describing their line of laboratory and process viscometers, rheometers, and accessories, is available from Brookfield Engineering Laboratories Inc. The catalog includes the new programmable DV-II+ viscometer.

Circle No. 34 on Reader Service Card

Technical Bulletin

In "Successful Use of Aerosil Fumed Silica in Liquid Systems," Degussa Corp. has outlined procedures that ensure Aerosil fumed silica meet performance requirements. Hydrophobic and hydrophilic Aerosil fumed silica grades are used in a broad range of liquid systems for viscosity control, anti-sag and anti-settling. Included in the bulletin are recommendations for finding the precise loading level, proper dispersion and long-term stability of systems.

Circle No. 35 on Reader Service Card

Dehumidifier Brochure

A complete line of desiccant dehumidifiers for commercial and industrial applications is described in a full-color, six-page brochure published by the Desicair Division of Air Technology Systems, Inc. The brochure features six product series of dehumidifiers that provide precise humidity and/or temperature control of storage, warehouse or manufacturing space, or a process air stream.

Circle No. 36 on Reader Service Card

Instrument Catalog

The Corporate Products Group of KTA-Tator, Inc., has published the new *Coatings Inspection Instrument Catalog*. The 40-page catalog contains pictures, descriptions, and pricing for over 100 coatings inspection instruments, and standards from leading manufacturers and organizations in the industry.

Circle No. 37 on Reader Service Card

Metal Framing Catalog

GS Metals Corp. is offering an 84-page catalog on their Globe Strut[®] metal framing systems. The catalog gives information and specifications on the systems, along with installation instructions and application suggestions. Other information includes load tables, physical and structural property lists, specific dimension diagrams, and product reference

numbers. The products featured include steel and aluminum channels, channel fittings, threaded rod support fittings, clamps, brackets and braces, concrete inserts and accessories, and hardware.

Circle No. 38 on Reader Service Card

Epoxy Brochure

A newly updated brochure, "Epoxy Curing Agents for Flooring Applications," has been published by Air Products and Chemicals, Inc. The brochure highlights the company's complete line of epoxy curing agents for flooring applications, including newer products such as Ancamine[®] 2368, Ancamine[®] 2423, and Ancamine[®] 2396. The brochure discusses specific curing agent recommendations for formulating self-leveling and trowelable floors. It also contains performance data on set time, physical properties, and chemical resistance for epoxy binder and aggregate-filled model flooring formulations.

Circle No. 39 on Reader Service Card



Paints/
Coatings

Primer

The Sherwin-Williams Co. has launched the Kem Flash[®] Ultra-Bond[™] Primer. It can be used with polyurethanes, alkyd enamels, and acrylic enamels. The high-solids, low-VOC single-component epoxy ester primer is also reportedly fast-drying and corrosion resistant. The primer can be applied using conventional spray, airless spray, air assisted airless, electrostatic, or high-volume low-pressure conventional spray.

Circle No. 40 on Reader Service Card

Architectural Finish

PPG Industries, Inc. has added Megaflon fluorocarbon coatings to their architectural finishes product line. The coatings are designed to cure chemically into a clear, inert, 100% fluorocarbon solution, without the need for multiple coats or additional clearcoat applications. These finishes adhere to steel, aluminum, concrete, glass, and many plastic surfaces. They can be applied by spray, brush, screen, or coil coating, and are reportedly resistant to marring and abrasion.

Circle No. 41 on Reader Service Card

Waterborne Finishes

A new family of KTM waterborne finishes has been introduced by Grafted

Coatings. KTM finishes are primarily for windows and doors. Among the new products are KTM-1 for sealing, KTM-A for porous woods like oak and mahogany, KTM-4 for fiberglass and PVC, KTM-5 for metals such as steel and aluminum, and KTM-8 primer for polypropylene.

Circle No. 42 on Reader Service Card

Carbides

A new series of abrasion and erosion resistant coatings for the protection of metal surfaces in severe service environments is now available from Materials Resources International. Infiltrated carbides are high performance wear cladding materials applied as flexible "pie dough" preforms. The coatings can be attached as a mat or spray, or dipped using a suspension.

Circle No. 43 on Reader Service Card



Laboratory Software

The industry-standard SQL*LIMS® Laboratory Information Management System is now available from PE Nelson, The Perkin-Elmer Corp., for use with Power Macintosh® desktop computers. The client application is implemented with Oracle® Developer/2000 tools and runs on the Macintosh operating system. Users can conduct various sophisticated operations on their laboratory results with the information controlled on the Oracle-based servers.

Circle No. 44 on Reader Service Card

Reflectance Data on Disk

Labsphere, Inc. offers laboratory measurement services for customer-supplied

solid and liquid samples at their reflectance research laboratory. Measurements are available in the UV-VIS-NIR and MIR-FIR wavelength ranges on a per piece or contract basis. Measurement data is provided in tabular or graphic format either on hardcopy or high-density floppy disks for ASCII, Lotus 1-2-3™, Microsoft Excel™, or JCAMP formats. The measurements are reportedly traceable to the National Institute of Standards and Technology, the National Research Council, Canada, and the National Physical Laboratory in the U.K.

Circle No. 45 on Reader Service Card



Line Delivery Devices

A new two-page, full-color data sheet profiling the Accustrip System® SX Line Delivery Devices is now available from Armex® Cleaning and Coating Removal Systems, a unit of Church & Dwight Co., Inc. The three models represented in the data sheet range in capacity from 50 lbs. to 200 lbs. The models are reportedly easy to operate, easy to maintain, and economical with a choice of nozzles to match various blasting applications.

Circle No. 46 on Reader Service Card

Gas Transmitters

The Industrial Scientific 6100 Series of transmitters were developed as a rugged sensor assembly for many explosive and hazardous gases. Offered by Industrial Scientific Corp., the transmitters are housed in explosion proof enclosures suitable for worldwide use in Class 1, Division 1 and 2, Groups B, C, and D hazardous locations. The instrument is controlled with push-button switches and is powered with 24 volts DC.

Circle No. 47 on Reader Service Card

Air Treatment System

Ultrafilter, Inc., Norcross, GA, has introduced the ultrapure ALG 20S-80S modular breathing air treatment systems for removal of CO and CO₂. The 'S class' is reportedly oil, taste, and odor free. The modular design is available in a stand-alone unit, manufactured to suit individual user flow rate requirements, and a packaged system designed for two to 16 users.

Circle No. 48 on Reader Service Card

Power Supplies

A new line of 100% solid state power supplies has been introduced by Lepel

Corp. The Lepel LSS line reportedly provides consistent power in lightweight and compact designs, and offers conversion efficiencies up to 85% to minimize energy costs and reduce water cooling requirements. Power, voltage, and current can be regulated by a control knob on the front panel. Models are available with output power ranging from 2.5 kW to 60 kW at frequencies between 50-200 kHz.

Circle No. 49 on Reader Service Card

Batch Processing Spray Unit

Linden/EMB has recently launched a batch processing spray unit that dispenses coatings without the use of solvents. The EZ-Coat™ system utilizes carbon dioxide as both the carrier and the atomizing agent. The system can produce coating viscosities up to 500,000 cps, is self-contained, and requires only 120 VAC electrical power, standard shop compressed air, and a carbon dioxide connection. The models are available from small portable lab units to high-usage production systems.

Circle No. 50 on Reader Service Card

Sealed Wash System

Progressive Recovery, Inc. has introduced the SWS 300, a sealed wash system designed for flexo and gravure press parts that reportedly minimizes the emission of wash solvents during the wash or dry cycle. This new system does not require a pit in the floor, and operates on a "closed loop" recovery system which allows the wash solution to be reused. The SWS 300 emits .6 pounds of emissions per wash cycle and can be designed to use either detergents or solvents.

Circle No. 51 on Reader Service Card

Screener

A full color six-page brochure on in-line pneumatic sifter/screening equipment designed to work in pressure or vacuum conveying systems is available from Great Western Manufacturing Co. The brochure provides detailed information, features, and specifications on the Model 611 and 631.

Circle No. 52 on Reader Service Card

Sit Down Blast Cabinets

A new line of blast cabinets has been introduced by Ehrsam™ Blast Systems. These cabinets feature a unique hopper that allows the operator to sit down while blasting in order to prevent fatigue. Designed for heavy-duty industrial use, the cabinets are constructed with heavy gauge welded steel and require a minimum of floor space.

Circle No. 53 on Reader Service Card

Mark Your Calendar...

FEDERATION OF SOCIETIES
FOR COATINGS TECHNOLOGY

ice
INTERNATIONAL
COATINGS EXPO
ON TECHNOLOGY CONFERENCE

International Coatings Expo &
Technology Conference
October 11-16, 1998
Memorial Convention Center
New Orleans, LA



Laboratory Apparatus

Sample Changer

Petrolab Co. has introduced the Autosampler, a 12-position sample changer for flash-point testing. The unit is designed to work with the PMA 4 Pensky-Martens flash point tester. It is equipped with a carousel that can hold up to 12 test cups. Each cup is closed with its own cover, temperature, and flash-point sensors. The dimensions of the unit are 86 x 50 x 58 cm.

Circle No. 54 on Reader Service Card

Moisture Meter

The Delmhorst Model BD-2000 Digital Moisture Meter has been added to the line of coatings inspection gauges and standards offered by KTA-Tator, Inc. The meter measures the moisture content of wood and gypsum, and has a reference scale for comparative readings on other non-wood materials. The meter also fea-

tures a liquid crystal display which indicates the moisture content, while light-emitting diodes provide a visual indication of moisture level. Equipped with green, yellow, and red lights that indicate the dryness of the coating surface, the meter comes complete with a 9V alkaline battery and carrying case, with optional interchangeable probes also available.

Circle No. 55 on Reader Service Card

Color Control for Plastics

A new CCI 7 Step Color Tolerance System has been launched by Color Communications, Inc. The system uses plastic standards in place of traditional coated standards. The plastic standards set acceptable limits for the color of products and packaging. Then, the same resin formulation of the final product is used to produce the standard. The user is able to create these plastic standards and tolerance sets from resins such as polypropylene, polystyrene, polyethylene, and a variety of engineering polymers.

Circle No. 56 on Reader Service Card

Sample Supplies

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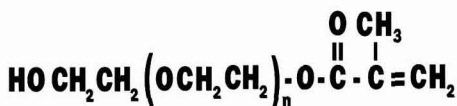
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FEDERATION MEETINGS



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. Web site: <http://www.coatingstech.org>

1998

(May 14-15)—FSCT Incoming Society Officers Meeting. May 14—FSCT Headquarters Visit; May 15—Meeting, Park Ridge Hotel and Conference Center, King of Prussia, PA.

(June 17-18)—“Switching from Solvent-Based to Water-Based.” Seminar sponsored by the FSCT Professional Development Committee. Hyatt Regency O’Hare, Chicago, IL.

(June 19)—“Technical Writing.” Workshop sponsored by the FSCT Professional Development Committee. Hyatt Regency O’Hare, Chicago, IL.

(July 23-24)—Panamerican Coatings Expo. World Trade Center, Mexico City, Mexico.

(September)—“Experimental Design and Analysis Workshop.” Seminar sponsored by the FSCT Professional Development Committee. Dates and location to be announced.

(Oct. 11-13)—ICE ’98—International Coatings Technology Conference. Ernest N. Morial Convention Center, New Orleans, LA.

(Oct. 14-16)—ICE ’98—FSCT Annual Meeting and International Coatings Expo. Ernest N. Morial Convention Center, New Orleans, LA.

(Nov. 4-5)—“Practical Rheology.” Seminar sponsored by the FSCT Professional Development Committee. Orlando Airport Marriott, Orlando, FL.

(Nov. 5-6)—“Extender Pigments.” Seminar sponsored by the FSCT Professional Development Committee. Orlando Airport Marriott, Orlando, FL.

1999

(Oct. 20-22)—ICE ’99—FSCT Annual Meeting and International Coatings Expo and Technology Conference. Dallas Convention Center, Dallas, TX.

SPECIAL SOCIETY MEETINGS

1998

(June 5-6)—Joint Meeting of the St. Louis and Kansas City Societies. Lake of the Ozarks, MO. (Randy Ehmer, 500 Railroad Ave., N. Kansas City, MO 64116; (816) 842-3014).

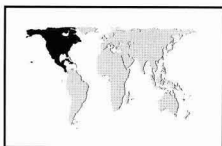
1999

(Feb. 16-18)—24th Biennial Western Coatings Societies’ Symposium and Show. Sponsored by the Golden Gate, Los Angeles, Pacific Northwest, and Rocky Mountain Societies. John Ascuaga’s Nugget, Sparks, NV.

OTHER ORGANIZATIONS

1998—North America

(May 13-15)—“Spray Finishing Technology Workshop.” Sponsored by Bowling Green State University and ITW DeVilbiss. Toledo, OH. (Richard A. Kruppa, Bowling Green State University, Bowling Green, OH 43403).



(May 17-20)—1998 Fluid Controls Institute Annual Meeting. The Cloister, Sea Island, GA. (Fluid Controls Institute, Inc., 1300 Summer Ave., Cleveland, OH 44115-2851).

(May 18-21)—“Coatings Science for Coatings Technicians.” Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(May 18-22)—“Physical Testing of Paints and Coatings.” Short course sponsored by University of Missouri-Rolla (UMR). Rolla, MO. (UMR Coatings Institute, 236 Schrenk Hall, 1870 Miner Circle, Rolla, MO 65409).

(May 19-21)—Finishing Technologies ’98. Conference and exhibition sponsored by *Coatings Magazine*. International Centre, Toronto, Ontario, Canada. (*Coatings Magazine*, 406 North Service Rd. East, Ste. One, Oakville, Ontario, Canada L6H 5R2).

(June 1-3)—“Colorimetry and Color Measurement.” Short course sponsored by Rochester Institute of Technology’s Munsell Color Science Laboratory. Rochester, NY. (Colleen M. Desimone, RIT Munsell Color Science Laboratory, 54 Lomb Memorial Dr., Rochester, NY 14623-5604).

(June 1-5)—“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).

(June 1-12)—“Intensive Coatings Science Course.” Sponsored by North Dakota State University (NDSU). Fargo, ND. (Debbie Shasky, Program Coordinator, 54 Dunbar Hall, NDSU, Fargo, ND 58105).

(June 4)—“Instrumental Color Matching.” Short course sponsored by Rochester Institute of Technology’s Munsell Color Science Laboratory. Rochester, NY. (Colleen M. Desimone, RIT Munsell Color Science Laboratory, 54 Lomb Memorial Dr., Rochester, NY 14623-5604).

(June 5-6)—Joint Meeting of the St. Louis and Kansas City Societies. Lake of the Ozarks, MO. (Randy Ehmer, 500 Railroad Ave., N. Kansas City, MO 64116; (816) 842-3014).

(June 7-10)—ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications. Sponsored by the American Society for Testing and Materials (ASTM), Omni Inner Harbor, Baltimore, MD. (Scott Orthey, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428).

(June 7-10)—ASTM Committee G03 on Weathering and Durability. Sponsored by the American Society for Testing and Materials (ASTM), Omni Inner Harbor, Baltimore, MD. (Scott Orthey, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428).

(June 8-12)—“Introduction to Paint Formulation.” Short course sponsored by University of Missouri-Rolla (UMR). Rolla, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409).

(June 8-12)—“Foundations of Color Management Systems.” Short course sponsored by Rochester Institute of Technology’s Munsell Color Science Laboratory. Rochester, NY. (Colleen M. Desimone, RIT Munsell Color Science Laboratory, 54 Lomb Memorial Dr., Rochester, NY 14623-5604).

(June 9)—ASTM D01.51 on Powder Coatings. Sponsored by the American Society for Testing and Materials (ASTM). Omni Inner Harbor Hotel, Baltimore, MD. (Jeffrey Hagerlin, O’Brien Powder Products, 9800 Genard Rd., Houston, TX 77041-7624).

(June 9-11)—1998 Department of Defense-Industry Aerospace Coatings Conference. Renaissance Waverly Hotel, Atlanta, GA. (Omar Deel or Rick Wolterman, Battelle, 505 King Ave., Columbus, OH 43201-2693).

(June 9-11)—Automotive Finishing ’98. Conference and Exposition sponsored by the Society of Manufacturing Engineers. Cobo Conference and Exhibition Center, Detroit, MI. (SME, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930).

(June 10-11)—“Standards for Asbestos Control.” Training course sponsored by the American Society for Testing and Materials (ASTM). Dallas, TX. (Kristina Falkenstein, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428).

(June 15-18)—“Coatings Science for Coatings Formulators.” Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(June 22-25)—“Coatings Science for Coatings Chemists.” Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(July 13-15)—“Basic Coatings for Sales, Marketing, and General Personnel.” Short course sponsored by University of Missouri-Rolla (UMR). St. Louis, MO. (UMR Coatings Institute, 236 Schrenk Hall, 1870 Miner Circle, Rolla, MO 65409).

(July 23-24)—Panamerican Coatings Expo. World Trade Center, Mexico City, Mexico. (Lisa McGlashen, FSCT, 492 Norristown Rd., Blue Bell, PA 19422; (610) 940-0777, FAX: (610) 940-0292. Web site: <http://www.coatingstech.org>).

(Aug. 31-Sept. 3)—“Safety in Ammonia Plants and Related Facilities.” Sponsored by the American Institute of Chemical Engineers (AIChE). Charleston Place, Charleston, SC. (AIChE, 345 E. 47th St., New York, NY 10017).

(Sept. 10-11)—“Engineering and Construction Contracting Conference.” Sponsored by the American Institute of Chemical Engineers (AIChE). The Phoenician, Scottsdale, AZ. (AIChE, 345 E. 47th St., New York, NY 10017).

(Sept. 14-18)—“Basic Composition of Coatings.” Short course sponsored by University of Missouri-Rolla (UMR). Rolla, MO. (UMR Coatings Institute, 236 Schrenk Hall, 1870 Miner Circle, Rolla, MO 65409).

(Sept. 17-20)—Polyurethanes Expo '98. Sponsored by The Polyurethane Division of The Society of the Plastics Industry, Inc.

Wyndham Anatole Hotel, Dallas, TX. (Polyurethane Division, The Society of the Plastics Industry, Inc., 355 Lexington Ave., New York, NY 10017).

(Sept. 22-24)—Powder Coating '98. Sponsored by The Powder Coating Institute. Indiana Convention Center, Indianapolis, IN. (Vicki Thatcher, Conference Coordinator, P.O. Box 54464, Cincinnati, OH 45254).

(Sept. 28-Oct. 2)—“Introduction to Paint Formulation.” Short course sponsored by University of Missouri-Rolla (UMR). Rolla, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409).

(Oct. 4-6)—Annual Fall Conference of The Society of the Plastics Industry Inc.'s Epoxy Resin Formulators Division. The Ritz-Carlton, Kansas City, KS. (Tina Kierzek, SPI Epoxy Resin Formulators Div., Ste. 600K, 1801 K St., Washington, D.C. 20006-1301).

(Oct. 11-13)—NPCA's 111th Annual Meeting. Sponsored by the National Paint and Coatings Association (NPCA). New Orleans Hilton Riverside, New Orleans, LA. (NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005-5597; (202) 462-6272).

(Oct. 11-13)—ICE '98—International Coatings Technology Conference. Ernest N. Morial Convention Center, New Orleans, LA. (FSCT, 492 Norristown Rd., Blue Bell, PA 19422; (610) 940-0777, FAX: (610) 940-0292. <http://www.coatingstech.org>).

(Oct. 14-16)—ICE '98—FSCT Annual Meeting and International Coatings Expo and Technology Conference. Ernest N. Morial Convention Center, New Orleans, LA. (Lisa McGlashen, FSCT, 492 Norristown Rd., Blue Bell, PA 19422; (610) 940-0777, FAX: (610) 940-0292. <http://www.coatingstech.org>).

(Oct. 25-28)—Fall Convention. Sponsored by The Adhesive and Sealant Council, Inc. Fairmont at Grant Park, Chicago, IL. (The Adhesive and Sealant Council, Inc., 1627 K St., N.W., Ste. 1000, Washington, D.C. 20006).

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1998—Australia

(July 29-Aug. 1)—“Coatings for the Future.” Second Trans Tasman Surface Coatings Conference. Co-sponsored by Surface Coatings Association, New Zealand, Inc., and Surface Coatings Association, Australia, Inc. The Carlton Hotel, Auckland, New Zealand. (98 Transtas Conference, P.O. Box 5192, Wellesley St., Auckland, New Zealand).



1998—Europe

(May 25-29)—1998 International Thermal Spray Conference. Sponsored by ASM International. Nice, France. (Congres Scientifiques Services, ITSC '98, 2 rue des Villarmains - BP 124, F-02210 Saint Cloud, France).



(June 8-11)—XXIV FATIPEC Congress. Interlaken, Switzerland. (AKM Congress Service, Postfach CH-4005 Basel, Switzerland).

(June 22-24)—“SURFEX '98.” Sponsored by The Oil & Colour Chemists' Association (OCCA). Harrogate, United Kingdom. (Christopher Pacey-Day, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, England HA0 2SF).

(June 23)—“Waterborne Versus High-Solids Protective Coatings.” Sponsored by Oil & Colour Chemists' Association (OCCA). St. George Swallow Hotel, Harrogate, United Kingdom. (OCCA, Priory House, 967 Harrow Rd., Wembley, England HA0 2SF).

(June 28-July 2)—Third Oxford Conference on Spectrometry. Co-sponsored by the Council for Optical Radiation Measurement of the United States and the Ultraviolet Spectrometry Group of the United Kingdom. Royal Holloway College of the University of London, Egham, Surrey, United Kingdom. (Art Springsteen, Third Oxford Conference, c/o Labsphere, Inc., P.O. Box 70, Shaker St., North Sutton, NH 03260).

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Humbug from Hillman

Recent mail brought in bundles of one liners. I am grateful to friends of Humbug who sent in enough to fill several columns. Allow me to settle for a good sampling.

Julius Nemeth has a number of questions. You supply your own answers.

- Is there another word for synonym?
- What was the best thing before sliced bread?
- How do they get the deer to cross at the yellow signs?
- If a man is speaking in the middle of the forest and his wife isn't around to hear him, is he still wrong?
- Why isn't there a mouse flavored cat food?
- Is a fly without wings called a walk?
- How come you never see any baby pigeons?
- If a parsley farmer is sued for back debts, do they garnish his salary?



Marv Schnall reported in with a long list of observations picked up from the Internet:

- On the other hand you have different fingers.
- I just got lost in thought. It was unfamiliar territory.
- I feel like I'm diagonally parked in a parallel universe.
- Honk if you love peace and quiet.
- Nothing is fool-proof to a sufficiently talented fool.
- Atheism is a non-prophet organization.
- He who laughs last, thinks slowest.
- Depression is merely anger without enthusiasm.
- I almost had a psychic girlfriend but she left me before we met.
- I intend to live forever—so far, so good.
- Support bacteria—they're the only culture some people have.
- I drive too fast to worry about cholesterol.



Joe Koleske provided us with another collection of Terry Marchal's columns. Among them, there was a new list of those frequently found student bloopers. Of course, they're always authentic.

- The earth makes a resolution every 24 hours.
- Involuntary muscles are not as willing as voluntary ones.
- A circle is a figure with no corners and only one side.

—All animals were here before mankind. The animals lived peacefully until mankind came along and made roads, houses, hotels, and condoms.

—Mushrooms always grow in damp places and so they look like umbrellas.

—The spinal column is a long bunch of bones. The head sits on top and you sit on the bottom.

—When oxygen is combined with anything, heat is given off. This is known as constipation.



And this from a Terry Marchal column:
One of Virginia Ireland's funny moments in life came some years ago when she saw a man, dripping wet, wrapped in a hastily arranged towel and carrying his clothes, come running out of the shower room at the YWCA while a female voice bellowed from behind:

"Men's night was yesterday!"



Dave Platt tells the story of the little old immigrant lady, in Miami, who stood before the judge asking for a divorce.

The judge asked, "What are the grounds?"
"Well, we have two acres in Miami Beach," she replied.

"Do you have any grudges?"

"One, your Honor. It holds three cars."

"Does your husband beat you up?"

"No, I get up before him."

"Why do you want a divorce?"

"Well, we don't communicate."



Marty Miller blames this one on *Reader's Digest*. A shortened version:

A teacher asked her class to illustrate adages in real life. Max raised his hand.

"My Uncle Jake was a fighter pilot in World War II. His plane crashed on an island in the South Pacific. On the island were 12 Japanese soldiers. All that my uncle was able to salvage from the wreck was a one-quart bottle of Scotch. He killed all the soldiers with his bare hands."

The teacher said, "I fail to see how an adage relates."
Max replied, "Never mess with my Uncle Jake when he's drinking."

(adage: a saying embodying common observation of ten in metaphorical form) So there!!

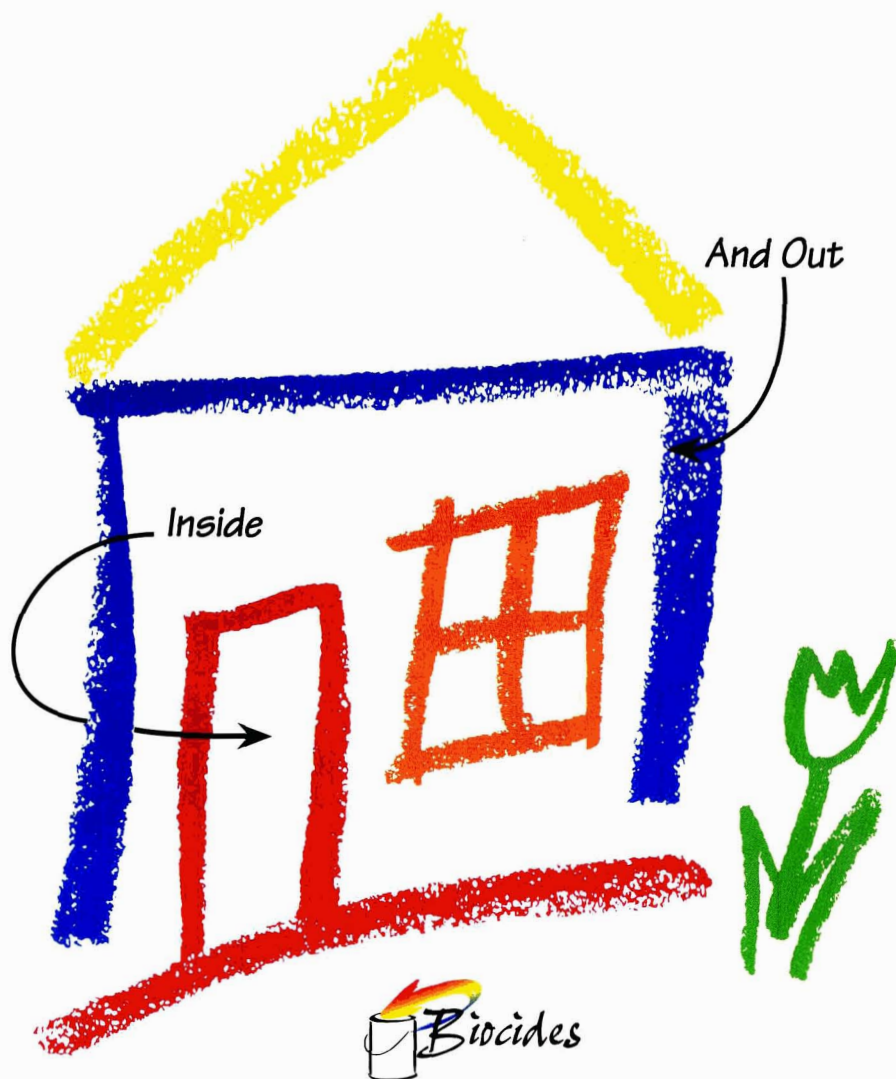
—Herb Hillman, *Humbug's Nest*,
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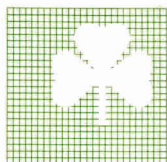


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