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JOURNAL OF COATINGS TECHNOLOGY

July 1992

Four Methods for Predicting the Flash Point of Alkyd Paints Containing VM&P Naphtha and Mineral Spirits - Part 1

A Method for Estimating the Flash Points Of Coatings Containing Mixtures of Oxygenated and Hydrocarbon Solvents and Petroleum Distillates Part 2

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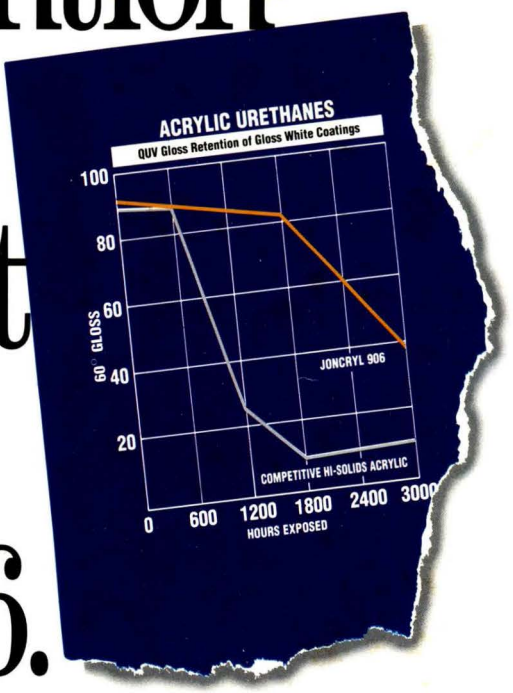

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OSHA amends Asbestos Standard to remove nonasbestiform minerals

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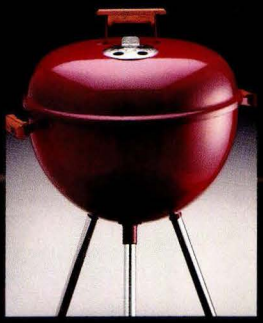

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The Federation of Societies for Coatings Technology assumes no responsibility for the opinions by authors in this publication.

Comment

Honor and Remembrance Fund Established by CIEF

The Coatings Industry Education Fund (CIEF) is both pleased and proud to announce the establishment of the new Coatings Industry Honor and Remembrance Fund, which will be administered by the trustees of the CIEF. This new fund is intended to provide an opportunity for individuals, corporations, and coatings societies and associations to honor those individuals in the coatings community, both living and dead, who have contributed to the advancement of their industry. Gifts in any amount will be recognized annually in the JOURNAL OF COATINGS TECHNOLOGY, and will be divided into the following five categories:

- Gifts up to $250
- Gifts from $250-$499
- Gifts from $500-$999
- Gifts from $1000-$9999
- Gifts from $10,000 and over

All gifts to the Honor and Remembrance Fund will be tax deductible to the extent that the law allows, and may be made as a direct gift to the Fund, as a gift in honor of a living person, or as a gift in remembrance of one who is deceased. Examples:

- The Acme Corporation
- The Ohio Coatings Society, in honor of Margaret Q. Browning
- Mr. and Mrs. Pierre Lundquist, in remembrance of John Z. Edwardson

It is the present intention of the CIEF Trustees to use the earnings from the principal of this fund for educational assistance in the form of scholarships, grants, and fellowships at colleges and universities with coatings programs.

This is a bold new venture which will enable every individual, corporation, and society associated with the coatings industry to really "make a difference," by helping to further the educational efforts of the CIEF, and also by recognizing specific individuals' contributions to our industry. Gifts of any size, which should be made payable to the "CIEF—Honor and Remembrance Fund" and mailed to the FSCT office, are warmly solicited, and will be deeply appreciated.

George R. Pilcher, President
Coatings Industry Education Fund

Abstracts of Papers in This Issue

(Translations provided by: French—Montreal Society Member Alain Brisson, of Hoechst Canada, Inc. and Spanish—Mexico Society Member Carlos Urbina, of Instituto Mexicano de Tecnicos en Pinturas y Tintas.)

Four Methods for Predicting the Flash Point of Alkyd Paints Containing VM&P Naphtha and Mineral Spirits—Part I—J.L. McGovern

Journal of Coatings Technology, 64, No. 810, 33 (July 1992)

Four methods are presented for the calculation of the flash points of petroleum distillate blends. Each method is used to calculate the flash points of 30 paints containing VM&P naptha and mineral spirits. These calculated flash values are shown to compare well with the flash points of the paints determined on a Setaflash 0ISF instrument.

A Method for Estimating the Flash Points of Coatings Containing Mixtures of Oxygenated and Hydrocarbon Solvents and Petroleum Distillates—Part II—J.L. McGovern

Journal of Coatings Technology, 64, No. 810, 39 (July 1992)

The flash point is an important property of a coating. Flash points are used by various regulatory agencies to classify coatings according to their relative flammability and to determine the container type and labeling, shipping, and storage requirements.

Flash points of solvent mixtures are sensitive to non-ideal behavior. Mixtures of oxygenated and hydrocarbon solvents often exhibit such non-ideal behavior. A method of calculating the flash points of coatings containing mixtures of oxygenated and hydrocarbon solvents and petroleum distillates is presented. The method accounts for mixture non-ideality by calculating component activity coefficients.

A comparison of the predicted flash points with actual flash points measured on a setaflash 01SF for seven coatings and eight thinners showed that 14 of 15 estimated flash values differed from the measured flash point by less than the reproducibility of ASTM D 3278-78.

Estimation and Prediction of Degradation of Coating Films by Frequency at Maximum Phase Angle—I. Sekine, K. Sakaguchi, and M. Yuasa

Journal of Coatings Technology, 64, No. 810, 45 (July 1992)

In real coating systems, the degradation of pigmented coating films was evaluated by

Quatre Méthodes Pour la Prédiction du Point d'éclair de Peintures Alkydes Contenant du Naphte V.M.P. et de l'essence Minérale—Iére Partie—J.L. McGovern

Journal of Coatings Technology, 64, No. 810, 33 (July 1992).

Quatre méthodes sont présentées pour le calcul du point d'éclair de mélanges à base de distillats de pétrole. Chaque méthode est utilisée pour le calcul du point d'éclair de 30 peintures contenant du naphte V.M.P. et de l'essence minérale. Ces valeurs calculées se comparent très bien avec les points d'éclairs des peintures déterminées avec l'instrument Setaflash 0ISF.

Une Méthode Pour l'estimation du point d'éclair de Revêtements Contenant des Mélanges d'hydrocarbures et de Distillats de pétrole—2ème Partie—J.L. McGovern

Journal of Coatings Technology, 64, No. 810, 39 (July 1992)

Le point d'éclair est une propriété importante d'un revêtement. Les points d'éclairs sont utilisés par diverses agences environnmentales pour classifier les revêtements selon leurs flammabilités relatives et pour déterminer le type de contenant, l'étiquetage, l'expédition et les besoins d'entreposage. Les points d'éclairs de mélanges de solvants sont sensibles à un comportement non-idéal. Des mélanges d'hydrocarbures se comportent souvent de façon non-idéale. Une méthode pour le calcul des points d'éclairs de revêtements contenant des mélanges d'hydrocarbures et de distillats de pétrole est présentée. Cette méthode tient compte des mélanges non-ideaux en calculant les coefficients d'activités des composés.

Une comparaison des points d'éclairs prédits avec les points d'éclairs actuels mesurés avec l'aide de l'instrument Setaflash 0ISF pour sept revêtements et huit diluants, démontrent que 14 des 15 points d'éclairs estimés diffèrent des points d'éclairs mesurés par moins que la reproduction de la méthode ASTM D 3278-78.

Cuatro Métodos Para Predecir el Punto de Inflamacion de Pinturas Alquidalicas que Contienen VM&P Nafta Y Naftas Diluyentes—Parte I—J.L. McGovern

Journal of Coatings Technology, 64, No. 810, 33 (July 1992)

Se presentan cuatro métodos para el cáloulo de los puntos de inflamación de mezclas de destilados del petroleo. Cada método se utiliza para calcular los puntos de inflamación de 30 pinturas que contienen VM&P nafta y nafta diluyentes. Los valores de inflamación calculados se muestran como comparación de los puntos de inflamación de pinturas determinados mediante el instrumento Setaflash 0ISF.

Un Método Para Determinar Puntos de Inflamacion en Recubrimientos que Contienen Mezclas de Solventes Oxigenados e Hidrocarburos y Destilados del Petroleo—Part II—J.L. McGovern

Journal of Coatings Technology, 64, No. 810, 39 (July 1992)

El punto de inflamación es una propiedad importante en los recubrimientos. Los puntos de inflamación son utilizados por varias agencias de regulación para clasificar a los recubrimientos de acuerdo a su flamabilidad relativa y determinar los requisitos en el tipo de contenedor, etiquetado, embarque y almacenamiento.

Los puntos de inflamación de mezolas de solventes siempre muestran un comportamiento no ideal. Las mezclas de solventes oxigenados e hidrocarburos también muestran un comportamiento no ideal. Se presenta un método para calcular los puntos de inflamación de recubrimientos que contienen mezclas de solventes oxigenados e hidrogenados y destilados del petroleo. El método se destina a mezclas no ideales mediante el calculo de los coeficientes de actividad.

Una comparación en los puntos de inflamación predichos con los actuales valores de puntos de inflamación medidos en el Setaflash 0SIF para siete recubrimientos y ocho thinners muestran que para 14 o 15 valores estimados de puntos de inflamación difieren por menos de la reproduoibilidad presentada en el estandar ASTM D 3278-78.

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the frequency at maximum phase angle ($f_{\theta max}$) obtained from electrochemical impedance measurement. The $f_{\theta max}$ and film resistance (R_f) by electrochemical impedance measurement showed a linear relationship on a log-log plot. The degradation of coating films would be predicted by the determination of $f_{\theta max}$ values. When the calculated values of $f_{\theta max}$ and R_f were corrected by phenomenological coefficient (ß) in the range of 0 to 1, its linear relation was nearly consistent with that obtained in the measured values.

A Review of Methods of CPVC Determination—Chicago Society for Coatings Technology

Journal of Coatings Technology, 64, No. 810, 51 (July 1992)

Various experimental methods have been used to determine the critical pigment volume concentration (CPVC) of coating systems. All of them involve the making of paints formulated over a range of pigment volume concentrations (PVC) and the examination of changes in the film properties. This paper reviews some of these methods. It then goes on to review the development of mathematical models to predict the CPVC and examine some of the factors affecting the measured CPVC in latex paints.

Estimation et Prédiction de la Dégradation de Feuils de Peintures Par la Fréquence à l'angle Maximum de Phase—I. Sekine, K. Sakaguchi, and M. Yuasa

Journal of Coatings Technology, 64, No. 810, 45 (July 1992)

Avec l'aide de divers revêtements, la dégradation de feuils pigmentés a été évaluée à l'angle de phase maximum ($f_{\theta max}$) obtenu par la mesure d'impédence électrochimique. La paramètre $f_{\theta max}$ et la résistance d'un feuil (R_f) tel que mesuré par impédence électrochimique a démontré une relation linéaire sur un graphique log-log. La dégradation de feuils serait prévisible selon les valeurs $f_{\theta max}$. Lorsque les valeurs calculées de $f_{\theta max}$ ont été corrigées avec l'aide du coefficient ß, pour une valeur de 0 à 1, la relation linéaire était compatible avec les valeurs mesurées.

Une Revue des Méthodes de Détermination de la CVPC—Chicago Society for Coatings Technology

Journal of Coatings Technology, 64, No. 810, 51 (July 1992)

Diverses méthodes expérimentales ont été utilisées pour la détermination de la concentration volumétrique pigmentaire critique (CVPC) de revêtements. Toutes ces dernières impliquent la fabrication de peintures formulées sur une gamme de concentration volumétrique pigmentaire (CVP) et l'inspection des changements des propriétés des feuils de peintures.

Cette publication revise quelques unes de ces méthodes. De plus, la revision du développement des modèles mathématiques pour prédire la CVPC est effectuée et examine les facteurs affectant la mesure de la CVPC de peintures au latex.

Estimacion y Prediccion de la Degradación en Películas de Recubrimiento Mediante la Frecuencia a Angulo de Fase Máxima—I. Sekine, K. Sakaguchi, and M. Yuasa

Journal of Coatings Technology, 64, No. 810, 45 (July 1992)

Se evaluó la degradación en películas pigmentadas de recubrimientos, en sistemas reales mediante la frecuenola a ángulo de fase máxima ($f_{\theta max}$) obtenida mediante mediciones electroquímicas de impedancia. La $f_{\theta max}$ y la resistencia de la película (R_f) obteniudas mediante mediciones electroquímicas de impendancia mostraron una relación lineal en una gráfica log-log. Se puede predecir la degradación de películas de recubrimiento mediante la determinacion de los valores de $f_{\theta max}$. Cuando los valores d $f_{\theta max}$ y de R_f determinados son corregidos mediante coeficiente fenomenológicos (ß) en el rango de 0 a 1, la relación lineal se vuelve estremadamente consistente con los valores obtenidos en las mediciones.

Una Revision a los Métodos Para la Determinacion del CPVC—Chicago Society for Coatings Technology

Journal of Coatings Technology, 64, No. 810, 51 (July 1992)

Se han utilizado varios métodos experimentales para determinar la concentración crítica del pigmento en volumen (CPVC) en recubrimientos. Todos ellos involuoran la producción de pinturas formuladas por arriba del rango de las concentraciones del pigmento en volumen (PVC) y el anãlisis de los cambios en las propiedades de la película. Este artículo revisa algunos de esos métodos. En función de esta revisión, se desarrollan modelos matemãticos para predecir la CPVC y examinar algunos factores que afectan la medición de CPVC en pinturas base latex.

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Also, blends of DOWANOL PnB with other P-series glycol ethers and/or C_4 alcohols yield organic phase coupling behavior comparable to EB.

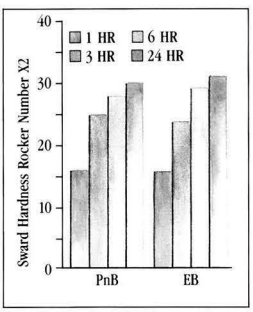

Figure 1 – Hardness Development Rates in Typical Acrylic-Based Latex

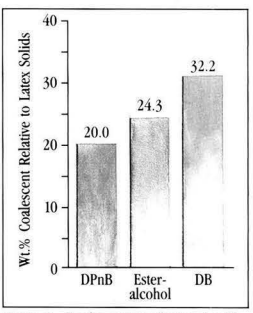

Figure 2 – Coalescent Levels Required for 50°F MFFT in Typical Acrylic-Based Latex

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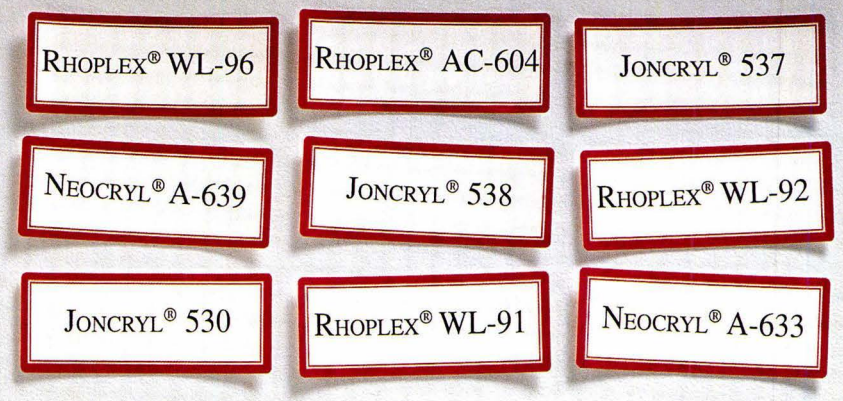

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1992 FSCT Spring Week Blossoms in Boston

Although Paul Revere and the Adams Family (John, Abigail, and John Quincy) are long gone, their presence can still be felt in the city of Boston, site of the ninth annual Federation Spring Week. Hosted by the New England Society, the FSCT events were greeted with glorious springtime weather that matched the mood of the attendees gathering in the historical city for the Board of Directors Meeting (May 17), Incoming Society Officers Meeting (May 18), and the FSCT Spring Seminar, "Understanding Corrosion Protection (How Rusty Are We?)" (May 19-20).

Board of Directors Highlights

Attendance (48): Thirty-five members of the Board, plus 13 guests (including one Past-President and six Society Officers).

FSCT Financial Report: 1991 Statement of Income and Expense and 1992 Operating Budget were reviewed in detail. The First Quarter 1992 Statement showed income and expense well within the budget set at $2.765 million.

Annual Meeting and Paint Show: Despite a stagnant economy, the 1991 events

Corrosion Committee Chairman Jay Austin introduced the Spring Week Seminar

in Toronto saw respectable attendance (7,812—the fourth largest) and a sold out Paint Show (81,240 sq. ft. of exhibit space). The program and plans for the 1992 events in Chicago are progressing well. Available exhibit space has been increased to almost 100,000 sq. ft. to meet demand and 95% is currently reserved. The Program Committee and its Chairman, John Lanning, are scheduling presentations under the theme, "New Directions for a Changing World." Housing and advance registration forms have been sent to all members.

gland. The proposed exhibit at Iron Bridge Gorge Museum, near Birmingham, would depict a small manufacturing facility and retail shop in circa 1909 England. The Club, which has assurances of local industry support, requested $8,000 from the Federation

FSCT President William Holmes and Executive Vice President Robert Ziegler led discussions on Administration/Committee Structure at the Incoming Society Officers meeting

Officer/Board Nominations: The slate for 1992-93, presented by the Nominating Committee is:

PRESIDENT-ELECT—John A. Lanning, of Louisville Society.

SECRETARY-TREASURER—Joseph P. Walton, of Cleveland Society.

EXECUTIVE COMMITTEE—Larry Brandenburger, of Northwestern Society (3 years).

BOARD (AT-LARGE)—Darlene Brezinski, of Chicago Society, and Peter Hiscocks, of Toronto Society (2 years).

BOARD (PAST-PRESIDENT)—John C. Ballard, of Louisville Society (2 years).

Society Business—Joanne Monique, member of the FSCT Membership Services Committee, presented Certificates of Appreciation to the Detroit, Philadelphia, and Mexico Societies for their outstanding membership gains during the year.

Birmingham Club Representative Gerry Gough presented a report on the Club's project of establishing a paint exhibit at a turn-of-the-century industrial museum in England. The proposed exhibit at Iron Bridge Gorge Museum, near Birmingham, would depict a small manufacturing facility and retail shop in circa 1909 England. The Club, which has assurances of local industry support, requested $8,000 from the Federation to proceed with the project. The Board voted to refer the question to the Executive Committee, which subsequently approved the expenditure.

Society Officers Meeting

Now in its 16th year, this annual orientation meeting for incoming Society Officers featured a new format. Attending Officers of 25 of the 26 Societies discussed their concerns and heard from FSCT Officers and Staff during five table-topic sessions. Both

(Continued on page 14)

Informal meeting format encouraged interaction between FSCT Officers, Staff and Incoming Officers in covering topics of concern such as Membership Retention and Promotion

FSCT Spring Week . . .

(continued from page 13)

lively and informative, discussions centered on such topics as: Administration and Committee Structure; Membership Retention and Promotion; Education and Program Development; Publicity and Public Relations; and Finances and Budgeting. The overwhelmingly successful full-day program gave all participants an overview of and insights into the challenges facing each organization.

Among the concerns expressed by participants was the need for information on Budgeting and Finances

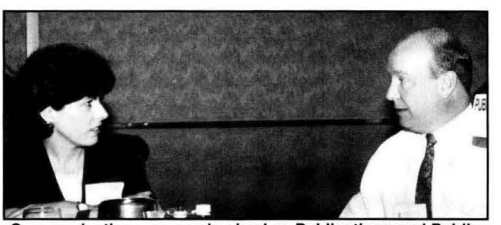
FSCT Spring Seminar

Developed by the Federation's Corrosion Committee (Jay Austin, Chair), the two-day seminar focused on the role of coatings in inhibiting corrosion and presented an in-depth view of corrosion basics, along with a review of coating evaluation and an update of formulation techniques. Attended by 94 persons, the seminar was divided into three segments: Corrosion Basics, Testing Techniques, and General Formulation/Technology, with presentations on the subjects "Fundamentals of Corrosion Beneath Protective Coatings," "Application of Phosphate Conversion Coatings for the Protection of Metals from Corrosion," "Design of Anti-Corrosive Coatings for Ferrous Substrates," "Characterization of Chromium-Free 'No-Rinse' Prepaint Coatings on Aluminum and Galvanized Steel," "Field Correlation of Cyclic and Conventional Salt Spray Testing," "Design of Experiments in Formulating," "Selection of Corrosion Test Methods Based on Mechanism Principles," "Survey by AC Impedance Techniques of Corrosion Protection by Organic Coatings," "Test Methods for High Performance Coatings Based on Electrochemical Impedance Spectroscopy," "Corrosion Improvement Factors for Direct-to-Metal and Primer Coatings," "Mechanism of Paint Deposition by Chemiphoresis," "Recent Developments in Organic Corrosion Inhibitors for Coatings," "Effect of Metal Sulfonates on the Corrosion Resistance and Other Properties of Coatings," "Stabilization of Anti-Corrosive Pigments in Waterborne Metal Protection Coatings and Enhancing Freeze Thaw Stability in Latex Paints Through the Proper Choice of Coalescent, Antifreeze and Amine," "New Raw Materials for Corrosion-Resistance Coatings," and, "Formulation Methodology for Waterborne Maintenance Coatings."

* * *

We sincerely thank the New England Society for its generous support of the Spring Week events and for its sponsorship of a guided tour of Boston. Also gratefully recognized is the support of the following organizations for their sponsorship of social events: Eastman Chemical Products, Inc.; Miles, Inc.; and, BYK-Chemie USA and BYK-Gardner, Inc. And, a very special "thank you" to the members of the FSCT Corrosion Committee for their efforts in developing the seminar program and for their assistance on-site.

Lively discussions were held on the topics of Education and Program Development



Communication was emphasized as Publications and Public Relations were discussed among the attendees

Participants of the Incoming Society Officers Meeting gathered together for a "team photo"

Preparations Underway for Largest Paint Industries' Show; Nearly 100,000 Sq. Ft. of Exhibit Space Is Contracted

An unequalled opportunity to attend the largest exhibition of products and services of suppliers to the international coatings industry will be presented as the Federation holds its 57th Paint Industries' Show, at McCormick Place North, Chicago, IL, on October 21-23. To accommodate the increasing demand by exhibitors, the Federation expanded exhibit space to nearly 100,000 square feet. Currently, over 95% of that space has been contracted by the key management, research and development, and supervisory personnel involved in the industry.

Displays will feature a wide variety of raw materials, production equipment, containers and filling equipment, laboratory apparatus, and testing devices for the paint and coatings producer. (*For current list of exhibitors, see page 28—Ed.*).

Exhibit hours will be 10:00 a.m. to 5:30 p.m. on Wednesday, Oct. 21; 9:00 a.m. to 5:30 p.m., on Thursday, Oct. 22; and 9:00 a.m. to 12:00 noon, on Friday, Oct. 23.

Annual Meeting Program

The Paint Show is being held in conjunction with the FSCT's 70th Annual Meeting. The Annual Meeting will explore the theme of "New Directions for a Changing World." The coatings industry's future depends on changing existing business strategies in formulating products, responding to regulatory and safety demands, and managing resources. New directions to be focused on include adopting merging and emerging technologies to drive innovation, developing environmentally friendly products and processes, and embracing total quality systems to effectively compete in a global market.

Highlighting the program will be the Mattiello Memorial Lecture, by Dr. John L. Gardon, of Akzo Coatings Inc., as well as Roon Award presentations and FSCT Constituent Society papers.

Several session themes have already been selected for the program. These sessions are being developed by various FSCT committees. The titles are as follows:

"Advanced Topics"—Professional Development Committee

"Employee Involvement—Overcoming the Obstacles to Empowerment"—Manufacturing Committee

"Formulation Factors for the Design of Corrosion-Resistant Direct-to-Metal (DTM) Coatings"—Corrosion Committee

"Merging/Emerging Technologies"—Program Committee

"Material Quality"—Program Committee.

Topics to be discussed include: powder coatings, waterborne paint systems, pigments for high performance coatings, corrosion inhibitors, low VOC coatings, wood finishing, paint filtration, recycling, epoxy resins, EB curing systems, adhesion promoters, and odor emissions.

A Poster Session, featuring noncommercial work in new ideas and techniques in coatings research, will be held on Thursday in the exhibit hall.

Program Committee

Program Committee Chairman John A. Lanning, of Courtaulds/Porter Paints, Louisville, KY, and his committee are developing the schedule of presentations. Assisting on the committee are: Clifford Schoff (Vice-Chairman), PPG Industries, Inc., Allison Park, PA; G. Dale Cheever, GM Corp., Research Laboratory, Warren, MI; Richard J. Himics, Daniel Products Co., Jersey City, NJ; Louis Holzknecht, Devoe Coatings Co., Louisville, KY; Ronda Miles, Union Carbide Corp., Garland, TX; Rose Ryntz, Akzo Coatings America, Inc., Troy, MI; and Roger Woodhull, California Products Corp., Cambridge, MA.

Host Committee

The Chicago Society will serve as the Host for the Annual Meeting. General Chairman of the 1992 Annual Meeting is Ted Fuhs, of Tru-Test Manufacturing Co., Cary, IL. Assisting him are the following sub-committee chairpersons: *Registration Area*—Patricia J. McGrath, of Ashland Chemical, Inc.; *Information Services*—Natu C. Patel, of Ace Hardware Corp., Paint Div.; *Program Operations*—Karl E. Schmidt, of Premier Coatings; *FSCT Exhibit*—Victor M. Willis, of Ace Hardware; *Hospitality Suite*—Thomas P. Yates, of United Coatings, Inc.; and *Spouses' Program*—Cynthia Fuhs.

Registration Fees

Advance registration forms and information have been forwarded to all members. Advance fees are $65 for members and $80 for nonmembers. The fee for spouses' activities is $50 in advance. Retired members and their spouses may register at the special advance-only fee of $25 each.

On-site registration will be $75 for full-time and $55 for one-day for members. Nonmember fees will be $95 for full-time and $70 for one-day. Spouses' activities will be $60 on-site.

Hotel Reservations

Seven hotels have reserved blocks of rooms for this event. The Chicago Hilton and Towers will serve as the headquarters hotel. Other hotels include Essex Inn on Grant Park, Executive Plaza Hotel, Hyatt Regency Chicago, McCormick Center Hotel, Palmer House Hilton, and Stouffer Riviere Hotel. All hotel reservations will be processed through the Chicago Convention & Tourism Bureau's FSCT Housing Bureau. Hotel reservation forms and information brochures have been mailed to all members.

Spouses' Activities

FSCT Spouses' Activities begin on Wednesday, October 21, with a wine and cheese social in the Chicago Hilton Hotel.

On Thursday, following a continental breakfast in the Chicago Hilton, registered

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1992 FSCT Mattiello Memorial Lecture

to be presented by

Dr. John L. Gardon,

of Akzo Coatings Inc.

"Polyurethane Polyols: Ester-Bond-Free Resins for High Solids Coatings"

October 23, 1992
McCormick Place North
Chicago, Illinois

FSCT Hosts Fall Quality Management Seminars

The Federation of Societies for Coatings Technology will offer two of its Quality Management seminars during the month of September in Atlanta, GA. Both seminars will be held at the Hyatt Atlanta Airport in the Georgia International Convention and Trade Center.

The course offerings are as follows:

"Statistical Process Control and Its Application in the Coatings Industry" (SPC Level I)—September 14-15, 1992. This seminar will cover the application of Dr. W. Edwards Deming's concepts which apply statistics to production samples to reduce variation and minimize waste. Among the topics to be covered are measuring the cost of quality, what is SPC?, benefits of SPC, introduction to attribute charts, and establishing an SPC program.

"Practical Application of Intermediate Statistics in a Total Quality Management System" (SPC Level II)—September 16-18, 1992. This seminar provides a "hands-on" approach to answer questions related to instituting a "Total Quality Management" (TQM) program within your company. These questions include:

- What are the components of TQM?
- How have other companies implemented TQM?
- How does Statistical Process Control fit into TQM?

The seminar will provide step-by-step guidelines to implement TQM within a company.

The seminars will be conducted by Dr. Peter Hunt, President of Productivity Management Consultants, in Clearwater, FL. Dr. Hunt has over 20 years of experience in Total Quality Management and has conducted numerous seminars on the topic. His courses are known for their "hands-on" approach to instruction. Dr. Hunt is a member of the American Society for Quality Control and is the author of several management texts.

For more information, contact Michael G. Bell, Director of Educational Services, FSCT, 492 Norristown Rd., Blue Bell, PA 19422-2350.

Annual Meeting . . .

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spouses will depart on deluxe motorcoaches for the Art Institute of Chicago and the John G. Shedd Aquarium.

Chicago's newest attraction, the Oceanarium at the Shedd Aquarium, will also be included in the tour. The Oceanarium is the world's largest indoor marine pavilion, and home to the Harbor Seals, Sea Otters, and Rockhopper Penquins.

Luncheon will be served at the Mid-America Club, located on one of the tallest buildings in Chicago, offering a spectacular view of the city's skyline.

The tour limit is 650. Advance registration is recommended.

Airline Information

The Federation's Travel Desk has negotiated reduced rates on United and USAir to Chicago featuring up to 40% discounts. For transportation arrangements, call:

1-800-448-FSCT or **215-628-2549**
Mention "*Paint Show 92.*"

An agent will make your reservations, write your tickets using your credit card number, and mail the tickets directly to you.

In addition, the official carriers may be contacted directly. Be sure to reference the file numbers as follow:

USAir 1-800-334-8644
Reference Gold File #62330000
United* 1-800-521-4041
Reference Meeting Code: 533GU
*Seven day advance purchase required.
Certain restrictions may apply.

Regulatory UPDATE

JULY 1992

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

Department of Transportation
Research and Special Programs Administration
June 9, 1992—57 FR 24532
Improvements to Hazardous Materials Identification Systems
Action: Advance notice of proposed rulemaking

The Research and Special Programs Administration (RSPA) is soliciting comments on a proposed rulemaking under the Hazardous Materials Transportation Uniform Safety Act of 1990.

RSPA is requesting comments to assist in determining: (1) methods to improve the current system of placarding vehicles transporting hazardous materials; (2) methods for establishing and operating a central reporting system and computerized telecommunications data center; and (3) the feasibility, necessity, and safety benefits of requiring carriers to establish continually monitored emergency response telephone systems.

Comments must be received on or before August 10, 1992, and should be submitted in quintuplicate to the Dockets Unit, Research and Special Programs Administration, U.S. Department of Transportation, Washington, D.C. 20590-0001. Please identify the comments with Docket (HM-206). For further information, contact John Potter, Office of Hazardous Materials Standards, RSPA, U.S. Department of Transportation, 400 Seventh St., S.W., Washington, D.C. 20590, (202) 366-4488.

Department of Transportation
Research and Special Administration
June 2, 1992—57 FR 23278
City of New York Application for Waiver of Preemption as to Fire Department Regulations Concerning Transportation of Flammable and Combustible Liquids
Action: Notice

The Research and Special Programs Administration (RSPA) has denied the City of New York's application to limit the capacity of trucks carrying flammable and combustible liquids. The decision includes trucks carrying paints, chemicals, and chemical wastes.

According to a Department of Transportation press release, the ruling was "based on the Hazardous Materials Transportation Act (HMTA), which provides for uniform Federal standards to promote public safety." These standards allow the use of trucks with larger tanks. RSPA denied the application to retain its capacity regulation because it found that large trucks, which operate nationwide, had no more frequent or serious accidents than the smaller trucks used under local regulations.

The agency determined that New York City's regulations did not meet Federal Safety Standards, and created an unreasonable burden on commerce.

For further information, contact Frazer C. Hilder, Office of the Chief Counsel, RSPA, U.S. Department of Transportation, Washington, D.C. 20590, (202) 366-4400.

Department of Labor
Occupational Safety and Health Administration
June 1, 1992—57 FR 23060
Process Safety Management of Highly Hazardous Chemicals
Action: Final rule; administrative stay

The Occupational Safety and Health Administration (OSHA) issued a final rule on February 24, 1992 on Process Safety Management of Highly Hazardous Chemicals that was scheduled to become effective on May 26. OSHA has extended the effective date until August 26, 1992 for certain provisions of the rule in order to evaluate the merits of petitions for further extensions. The extension applies to operating procedures, contractors, mechanical integrity, and management of change.

For further information, contact James F. Foster, OSHA, Room N3649, U.S. Department of Labor, Washington, D.C. 20210, (202) 523-8248.

Environmental Protection Agency
June 1, 1992—57 FR 23062
Hazardous Waste Management System; Definition of Hazardous Waste; "Mixtures and Derived-From" Rules
Action: Interim final rules; technical correction

In its March 3, 1992 repromulgation of the 40 CFR 261.3, (rules that are part of the definition of hazardous waste under RCRA), EPA inadvertently omitted language

that had been promulgated in 1991. These rules define "hazardous waste" to include mixtures of hazardous waste with other solid waste and the residue from managing listed hazardous waste.

The agency neglected to add an amendment clarifying that "wastes exhibiting a hazardous characteristic at the point of generation may still be subject to the land disposal restrictions of 40 CFR part 268, even if the wastes no longer exhibit the characteristic at the point of land disposal." The rule is effective June 1, 1992.

For further information, contact Marilyn Good, Office of Solid Waste (OS-332), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 260-8551.

Environmental Protection Agency
May 18, 1992—57 FR 21086
Agency Information Collection Activities Under OMB Review; Surface Coating Survey in New York City Area
Action: Notice

A one-time survey of facilities in the New York City area that perform surface coatings of miscellaneous metal parts will be conducted by EPA's Region II.

The estimated 300 respondents will be asked to provide information on coatings operations performed at their facilities over a 30-day period. The purpose of the survey is to evaluate the effectiveness of a regulation governing air pollution from coatings facilities. The data collected will also be used to verify emission inventories of volatile organic compounds (VOCs).

For further information, contact Sandy Farmer, U.S. EPA, Information Policy Branch (PM-2234), 401 M Street, Washington, D.C. 20460, (202) 260-2740.

Resource Conservation and Recovery Act (RCRA)—On May 20, the Senate Environment and Public Works Committee approved legislation reauthorizing the Resource Conservation and Recovery Act (RCRA). Several amendments were considered before the final vote of 12-5 to report the bill to the full Senate.

The committee approved an amendment offered by Sen. Dave Durenberger (D-MN), that would limit RCRA's domestic sewage exclusion. According to Sen. Durenberger, wastes are exempt from regulation if they are mixed with domestic sewage and sent to publicly owned sewage treatment plants. The amendment would retain the exclusion for "industries operating in compliance with a national pretreatment standard, industries that treat their wastes to RCRA Subtitle C Standards, and very small quantity generators." The committee adopted another Durenberger Amendment that would prohibit the use of any recycling symbol until EPA develops regulations and authorized its use.

Sen. Joseph Lieberman's (D-CT) amendment clarifying the effective date for the bill's metals-in-packaging provision (24 months after enactment) was also approved. The language in that amendment is identical to all the State Council of Northeast Governors (CONEG) packaging bills.

As with the House RCRA bill, both environmentalists and industry groups are unhappy with S. 976. Environmental groups criticized the bill for not addressing major waste provisions including industrial nonhazardous wastes, which they say account for 55% of the total waste stream. The groups also criticized the committee for not addressing the EPA's plans to exempt 25 to 40% of wastes regulated as hazardous under RCRA. The environmentalists are, however, pleased with the pollution prevention planning program and a community-right-to-know provision that would "require companies to report on their use and emissions of toxic chemicals."

The chemical industry is particularly concerned because the bill "fails to address several major issues, including the corrective action program, and a less burdensome program for dealing with industrial nonhazardous waste." All of Title II, which deals with pollution prevention and reporting requirements under the Toxic Release Inventory (TRI) is also a source of contention.

The legislation is expected to be debated before the full Senate later this summer.

Meanwhile, in an attempt to approve a reauthorization bill this year, the House Energy and Commerce Committee removed all of the hazardous waste provisions previously approved by the Transportation and Hazardous Materials Subcommittee. Both industry groups and environmentalists agree that while chances for approval are greater, the current bill is seriously flawed. The subcommittee-approved provisions that have been deleted include: "municipal solid waste incinerator disposal; toxic metals in packaging; Federal procurement of recycled goods and Commerce Department assistance in marketing those goods; underground storage tanks, hazardous wastes from laboratories; disposal of solid waste; and other technical amendments."

Despite agreeing to remove these issues for full committee markup, Rep. Al Swift (D-WA), Chairman of the Subcommittee on Transportation and Hazardous Materials, will reportedly try to offer controversial hazardous waste amendments when the bill gets to the floor. Included in the alleged list of amendments will be provisions covering "toxic use reduction and expanded emissions reporting; Federal procurement of recycled materials, and legislation to address EPA's mixture and derived-from rules."

The full committee is expected to markup the bill before the July 4th recess.

Lead—On July 1, the House Ways and Means Subcommittee on Select Revenue will hold a hearing on H.R. 2922, the Lead Paint Hazard Abatement Act, according to an announcement released by the committee. The purpose of the hearing is to discuss the issue of taxing the lead industry to pay for lead-based paint abatement.

The legislation would allow states to receive grants for removing lead-based paint from low income housing and day care centers. Grant money would be allocated from a trust fund financed by a "tax on lead removed from any U.S. smelter and on lead imported for consumption, use, or warehousing." The press release said the tax would be 75 cents per pound on primary lead (newly mined lead), and 37 cents per pound on recycled lead.

Occupational Safety and Health—Despite a veto threat by President Bush, the House Education and Labor Committee approved legislation (H.R. 3160) that would strengthen Federal worker-safety laws under the 1970 Occupational Safety and Health Act.

Under current law, only employers can be held liable for violations of Federal health and safety laws. The bill extends those penalties to individuals who supervise workers. A supervisor whose willful violation of health and safety laws resulted in an injury could receive up to five years in prison.

If the violation resulted in the death of a worker, the sentence could be doubled. The bill also requires all employers with 10 or more employees to establish health and safety committees to put together a comprehensive safety plan for the employees.

While a package of amendments addressing the concern that the legislation is economically burdensome on businesses was approved, the revisions were not satisfactory to several Republican members. Those members, instead, offered a substitute that would have required the government to consider a rule's cost effectiveness and its possible effect on employment when developing health and safety standards. The amendment was rejected. Because of the controversial nature of the bill, it is unlikely that it will pass this year.

Indoor Air Quality—Rep. Joseph Kennedy, II's (D-MA) indoor air quality bill, H.R. 1066, that was introduced last year is being redrafted to focus more on additional research rather than the current language that mandates burdensome Federal standards. The new draft is expected to be ready for a mid-summer markup by the House Education and Labor Subcommittee on Health and Safety.

Rep. Robert Andrews (D-NJ), a member of the subcommittee, agreed to help Rep. Kennedy redraft the bill after the administration and several industry representatives objected to rigid ventilation standards and inflexible mandates for Federal agencies to issue regulations. The 1991 version of the bill would have allocated $25 million over a five-year period for indoor air quality research and another $28.5 million for state and local programs and to help agencies adopt minimum air quality standards.

A provision vehemently opposed by industry would have required manufacturers to label each product with detailed chemical emission information. Reportedly, the new bill will address these concerns by emphasizing indoor air research. According to House staff, Rep. Andrews is assisting with the redraft because "he feels its a very important problem but some of the regulatory provisions may be premature because there is no scientifically driven research on the causes of indoor air problems." Ideally, Rep. Andrews would like "a year or two" to study the causes and effects of indoor air quality problems before legislating a specific regulatory bill.

In response to concerns by workers who have repeatedly complained that Federal agencies are not capable of responding to indoor air problems, the Kennedy/Andrews bill will contain a provision directing OSHA to respond to these complaints. OSHA will also set a "threshold" to guide the agency's inspections following a complaint by a worker.

The Senate passed its own indoor air bill sponsored by Sen. George Mitchell (D-ME) that provides $48.5 million for indoor air research

Product Liability—Proponents of Federal product liability legislation have threatened to attempt to amend every bill that reaches the Senate floor until the Democratic leadership agrees to hold a roll call vote on the merits of the bill.

Early in May, the first attempt was made when the Product Liability Fairness Act (S. 640) was offered as an amendment to the voter registration legislation. Only after a four-hour debate and an attempt to invoke cloture, was the amendment tabled by a "very close" vote. Bill Fay, Executive Director of the Product Liability Coordinating Committee, reportedly on the recommendation of Sen. John Danforth (D-MO), is heading up the no-holes-barred strategy because, he said, "Sen. Mitchell has made it clear he will not bring up S. 640 as a stand-alone measure."

The amendment would set uniform standards under which manufacturers would be liable for injuries incurred from faulty products. It also sets a higher burden of proof for plaintiffs suing to receive awards. Product liability bills have been introduced every year for the last 12 years, but Congress has been unable or unwilling to move the legislation.

States Proposed Legislation and Regulations

California

Recycling—CA A. 2446 (Eastin) requires the California Integrated Waste Management Board, in consultation with the Department of General Services to establish, by July 1, 1994, minimum recycled content standards for products including compost, glass, oil, plastic, and paint if these products are to be marketed as recycled. The bill passed the Assembly on May 27 and was sent to the Senate Committee on Governmental Organization.

Lead—CA A. 3487 (Friedman) adds lead-related work, as defined, to the list of employments or places of employment that require the issuance of a permit. Requires the Division of Occupational Safety and Health to propose a regulation containing specified requirements relating to lead-related work to the Occupational Safety and Health Standards Board for its review and adoption. The bill passed the Assembly on May 28 and was sent to the Senate.

Occupational Safety and Health—CA S. 1742 (Petris) entitles an employee under occupational safety and health standards to recover all other damages of any kind, including costs and reasonable attorney's fees, or a specified sum, whichever is greater, the sum of which shall be tripled, caused by acts or omissions of employer. The bill passed the Senate on May 21 and was sent to the Assembly Committee on Labor and Employment.

Packaging—CA A. 2393 (Cortese) requires the California Integrated Waste Management Board to conduct a study of heavy metals in product packaging, and to report the results of the study to the Governor and the Legislature by January 1, 1995. Prescribes the minimum contents of the report. The bill passed the Assembly on May 14 and was referred to the Senate Committee on Governmental Organization on May 22.

Air Quality—CA S. 1731 (Calderon) includes in the definition of toxic air contaminants all of the hazardous air pollutants listed in certain provisions of the Federal Clear Air Act. Requires air pollution control districts and air quality management districts to submit to the EPA a program for compliance with the provisions of the Federal act applicable to hazardous air pollutants, and an operating permit program which complies with the Federal act. The bill was amended in the Senate on May 26. To third reading.

CA S. 546 (Presley) requires the South Coast Air Quality Management District to establish economic incentive pro-

grams to comply with the Federal Clean Air Act. Defines a substitute roll call for purposes of voting on items on the district agenda. Requires the south coast district to establish a specified small business technical and compliance assistance program. The bill passed the Senate in May 1991. It was amended in the Assembly on May 22 and re-referred to the Committee on Natural Resources.

Environmental Marketing—CA A.B. 144 (Sher) prohibits the representation of any consumer good, or any part, ingredient, or packaging of a consumer good, by the terms "ozone friendly," "biodegradable," "photodegradable," "recyclable," "recycled," or "compostable," unless it meets definitions in regulations adopted by the EPA. Prohibits advertising or labeling of a consumer good as being not harmful to or as beneficial to the environment unless information is documented and verifiable. Redefines terms. The bill passed the Assembly in June 1991. On May 18, the bill was reported from the Senate Committee on Business and Professions without further action.

Colorado

Air Quality—CO S. 97 (Tebedo) concerns clean air, and, in connection therewith designates the Office of Regulatory Reform to act as Ombudsman to provide assistance to small businesses in the implementation of the Federal Clean Air Act Amendments of 1990. Makes an appropriation. The Senate concurred in House amendments on May 6, and the bill was sent to the Governor on May 18.

CO S. 105 (Norton et al.) amends the air pollution control law so as to be in compliance with and to implement the Federal Clean Air Act Amendments of 1990. The bill was signed by the Governor on May 27.

Illinois

Air Quality—IL H. 4037 (Ryder) amends EPA Act; creates the Clean Air Act Permit Program; requires such sources of pollution to obtain permits from EPA; regulates such pollution in accordance with the Federal Clean Air Act. The bill passed the House on May 22 and was sent to the Senate.

Hazardous Waste (Regulation)—Rules have been proposed in Illinois to increase some fees paid by those who dispose of hazardous materials. Fees for landfilling and incinerating wastes would be raised to 27 cents per gallon and fees for treatment would be raised to 13.65 cents per gallon under the new plan.

Kentucky

Air Quality: Publication of Amended VOC Regulations—Kentucky has published in final form amendments to its air quality regulations that were mandated by the Federal Clean Air Act Amendments of 1990. Several surface coating VOC limit regulations are affected by the revisions. (18 *Administrative Register of Kentucky* 3329—June 1, 1992.)

Maryland

Packaging—MD S. 554 (Boozer et al.) prohibits, on or after July 1, 1993, a manufacturer or distributor from selling or offering for sale or for promotional purposes any package or packaging component or any product in a package or packaging component to which lead, cadmium, mercury, or hexavalent chromium was intentionally added during manufacture or distribution; establishes maximum allowable concentration levels for those toxics that are incidentally presented in packaging materials. The bill was signed by the Governor on May 26.

Lead—MD H. 1265 (Rosenberg and Thomas) establishes the Lead Paint Poisoning Prevention and Compensation Commission for the purpose of preventing lead paint poisoning and for funding medical rehabilitation for lead poisoning claimants. The initial funding mechanism was to be monies collected from paint retailers who would have been taxed between $.50 to over $1.00 per gallon. The paint retailing and manufacturing community launched a grassroots effort opposing the tax, resulting in the deletion of the tax from the final proposal. The bill was signed by the Governor on May 12.

Massachusetts

Paint Disposal—MA H. 313 (Murray) provides for a paint recycling program. The bill was reported favorably from the Joint Committee on Commerce and Labor on May 14.

MA H. 5628 (Hynes) relates to disposal of paints and pesticides. The bill was introduced on May 15 and referred to the Joint Committee on Natural Resources and Agriculture.

Lead—MA H. 3371 (DiMasi and Magnani) establishes a fund to assist local housing authorities and owners of private property receiving Federal or state rental subsidy to remove lead-based paint. The bill was released from the Joint Committee on Housing and Urban Development with H. 5646 on May 14.

MA H. 5514 (Jehlen) creates statutory remedy for recovery of damages resulting from lead-based paint poisoning pursuant to a "market share" theory. The bill was introduced on May 1 and referred to the Joint Committee on Health Care.

Labeling—MA H. 4806 (Hodgkins) regulates the sale of certain hazardous products in retail establishments. Provides information to retailers with respect to the hazardous products and alternatives to those products. Requires labels for retail use with respect to such hazardous products. Provides pamphlets for consumers, made available by retailers at the point of sale, describing the toxicity of such hazardous products and alternative products. Requires that retail establishments display such labels on shelves or immediate vicinity. The bill was released from the Joint Committee on Commerce and Labor on May 14.

MA H. 4624 (Cahir) establishes a retail hazardous products identification program. The bill was released from the Joint Committee on Commerce and Labor with H. 5634 on May 14.

Occupational Safety and Health—MA H. 3498 (Bump) expands protection for injured or ill employees in the work place. The bill was released from the Joint Committee on Commerce and Labor with H. 5634 on May 14.

Michigan

Air Quality: Hazardous Air Pollutants; General Regulatory Requirements Affecting Emissions from Surface Coating Processes—Michigan has promulgated regulations pertaining to its program to regulate emissions of hazardous air pollutants through preconstruction permits that must be obtained for "any proposed new or modified process or process equipment." The regulations provide exemptions to the otherwise required use of "best available control technology

(BACT) for toxics" for volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) listed by the Federal Clean Air Act provided the emissions are already controlled by BACT or Lowest Available Emission Rate (LAER) requirements and their impact is less than cancer screening levels specified by the regulations. The regulations also contain important definitions and other revisions that affect regulated air pollutants from general surface coating processes. (*Michigan Register* 18—May 31, 1992.)

Clean Water: General Permits—Michigan has proposed regulations that, among other things, would establish a general permit system that would facilitate compliance with new Federal stormwater discharge requirements. (*Michigan Register* 67—April 30, 1992.)

Labeling—MI S. 912 (Pollack) requires labeling of products or materials containing certain heavy metals. Prescribes powers and duties of certain state agencies and officials. The bill was introduced on May 12 and referred to the Senate Committee on Natural Resources and Environmental Affairs.

Minnesota

Air Quality: Permit Fees and Emissions Inventories—Minnesota has proposed regulations that would assess air pollution emission fees from stationary sources. Indirect sources would be included in the fee system. The regulations also would establish methods by which facility owners would determine inventories of regulated emissions. (16 *Minnesota State Register* 2394—May 4, 1992.)

Missouri

Air Quality—MO S. 544 (Goode) revises Missouri's Air Law, primarily to accommodate the new requirements of the 1990 Clean Air Act Amendments. Creates a criminal penalty for violating Missouri Air Law, rules and standards. Expands definition of a regulated source to include sources which emit hazardous air pollutants. Both the Senate and the House adopted the Conference Committee Report on May 15.

New York

Air Quality: Surface Coating VOC Limit Regulations Would Be Extended—New York has proposed to extend the application of its current volatile organic compound (VOC) limit regulations for surface coating processes. The surface coating regulations currently applicable statewide would apply to sources with the potential to emit 10 tons per year of VOCs. Those currently applicable in the New York Metropolitan Area would be extended to the rest of the state to apply to sources with the potential to emit 50 tons per year of VOCs. An early reduction program would allow facilities to reduce emissions so as to escape the application of the regulations.

Lead—NY A. 11670 (Eve et al.) enacts the Comprehensive Lead Poisoning Prevention Act. Makes various provisions for regulations for lead poisoning prevention, case management of children with elevated lead levels, and minimizing exposure to environmental lead. Requires insurance coverage for lead screening services and provides for licensing of contractors involved with lead removal projects. Imposes a 25 cent per gallon tax on the sale of paint. The bill was introduced on May 18 and referred to the Assembly Committee on Health. The companion bill, S. 8559 (Volker), was introduced on May 28 and referred to the Senate Committee on Rules.

Note—Sen. Volker's office has indicated that these lead bills will not move during this session of the legislation. Gov. Cuomo is working on his own lead bill (without the tax) that may or may not be introduced this year. The New York legislature is expected to adjourn July 3.

Graffiti—NY S. 1592 (Padavan) imposes criminal sanctions upon persons who deface public or private property by means of aerosol paint cans. The bill passed the Senate on May 18 and is currently in the Assembly Committee on Codes.

NY A. 3620 (Weprin) authorizes the New York City departments of consumer affairs, sanitation, environmental protection, and transportation and the New York City police department to issue summons for violations involving the sale of aerosol spray paint cans and broad tipped indelible markers. The bill was amended in the Assembly on May 12 and returned to the Committee on Cities.

NY A. 2981 (Hillman and Jenkins) prohibits conduct resulting in graffiti on any public transportation facility. Establishes a minimum sentence for violations. On May 27, the bill was released from the Assembly Committee on Transportation and sent to the Assembly Committee on Codes.

Toxic Chemical Release—NY S. 8099 (Masiello) enacts the Multi-Media Toxic Chemical Release Inventory Act. Requires reporting on facilities where toxic chemicals are stored. Provides for assessment of data, fees per facility, and related provisions. The bill was introduced on May 11 and referred to the Senate Committee on Environmental Conservation. (Companion bill to NY A. 3845.)

Packaging—NY A. 9245 (Hinchey et al.) enacts the Environmentally Sound Packaging Act; requires packaging to be reusable or recyclable; provides exceptions and makes related provisions. The bill was amended in the Assembly Committee on Codes on May 14 and referred to the Committee on Ways and Means.

North Carolina

Occupational Safety and Health—NC S. 985 (Plyler) requires certain employers to establish safety and health programs and safety and health committees in the workplace. The bill was introduced on May 26 and referred to the Senate Committee on Judiciary II.

Oklahoma

Occupational Safety and Health—OK H. 2189 (Paulk) amends sections relating to occupational health and safety to prohibit adverse personnel actions against employees for filing complaints or testifying about hazards in the workplace; requires employers to report certain accidents in writing to the Oklahoma City office of the Department of Labor; requires transmission of certain statistics of fatal occupational injuries from the Department of Health to the Department of Labor; outlines prohibited conduct by an employer and setting penalty. The bill was signed by the Governor on May 27.

Hazardous Waste—OK S. 922 (D. Williams and Maxey) creates the crimes of unlawful waste transportation, unlawful waste management, unlawful misrepresentation of waste, unlawful disposal of hazardous waste, and unlawful concealment of hazardous waste; sets fines and sentences for persons convicted of environmental crimes and providing for fines to be doubled for multiple violations. The bill was sent to the Governor on May 25.

Hazardous Waste (Regulation)—The Oklahoma State Board of Health has promulgated final rules specifying per-

mitting and operating requirements for hazardous waste recyclers. The rules also revise fees and establish additional waste analysis and closure requirements for recyclers and treatment, storage, and disposal facilities. The rules became effective May 1. For further information, contact Chris Varga, State Board of Health, (405) 271-7047.

Oregon

Hazardous Waste (Regulation)—The Oregon Department of Environmental Quality has proposed rules that would modify hazardous waste generator fees, specify procedures to deregulate recycled chlorofluorocarbons, eliminate double hazardous waste evaluation requirements for certain pesticide wastes, and revise the listing of designation of aquatic toxicity hazardous wastes. For further information, contact Gary Calaba, Department of Environmental Quality, (503) 229-5913.

Pennsylvania

Packaging—PA S. 1733 (Fisher et al.) provides for the removal of toxics in packaging. Gives the Department of Environmental Resources certain responsibilities. Provides for enforcement and penalties. The bill was introduced on May 22 and referred to the Senate Committee on Environmental Resources.

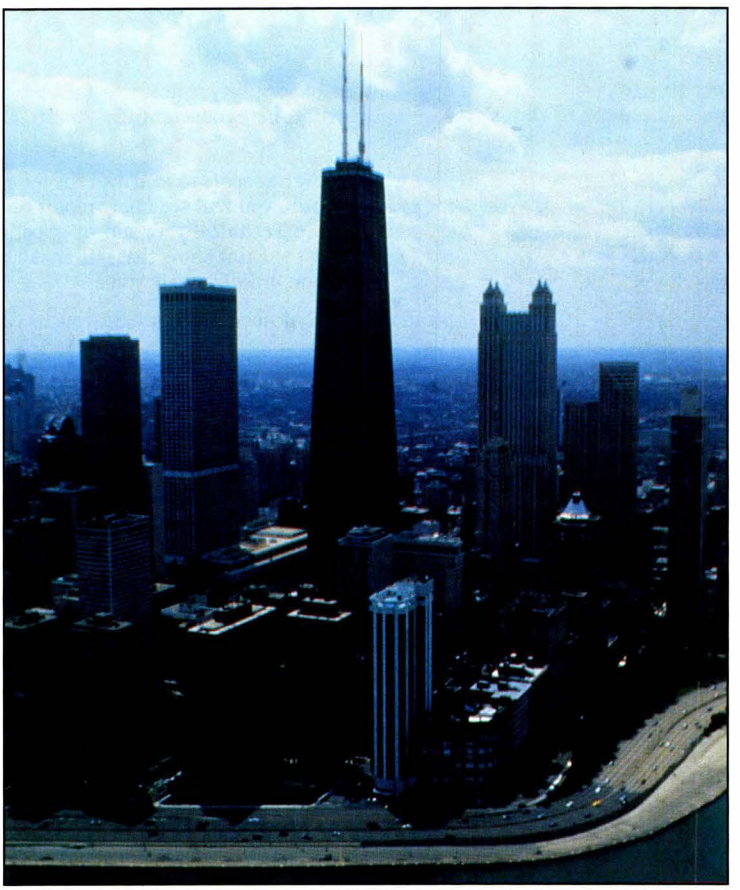
Texas

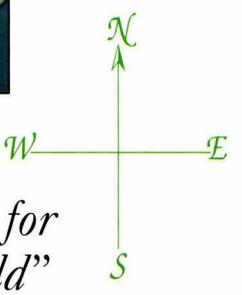
Environmental Product Fees—As part of its efforts to consolidate separate state environmental agencies into the Texas Natural Resource Conservation Commission, Texas is examining assessing environmental fees on products, such as paint and coatings, to defray the costs of environmental programs associated with the production, consumption, and disposal of the products.

Federation of Societies for Coatings Technology

1992 Annual Meeting & Paint Industries' Show

Hotel Information/Reservation Application
• Advance Registration Form •





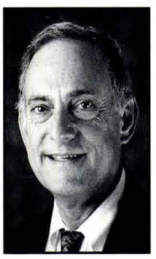
"New Directions for a Changing World"

McCormick Place North
Wednesday, Thursday, Friday • October 21-22-23, 1992
Chicago, Illinois

The combined Annual Meeting and Paint Industries' Show is a major educational activity of the Federation. This international coatings manufacturing industry event consists of three days of technical program sessions and exhibits, running concurrently. Registration is required for admission.

From the President:

It's been four long years since the Federation has held its Annual Meeting and Paint Show in Chicago. The industry has changed greatly since 1988, especially in the areas of compliance with regulations and the technology needed to maintain and prosper in these difficult times.



As always, the mission of the FSCT is the technical advancement and education of both its membership and the industry. The highlight of our efforts, the Annual Meeting and Paint Show, offers the best opportunity around to get the knowledge and insight to help your company—and to help yourself.

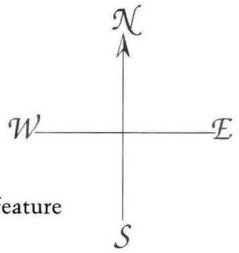
Please take a few moments to read over the following pages. I'm sure you will see many topics being presented in the Technical Program or suppliers participating in the Paint Show that will make the difference for you in 1992 and beyond.

Meanwhile, I look forward to seeing you in Chicago!

William F. Holmes
President, FSCT

Photo courtesy of Gene Hickmott/Chicago Convention & Tourism Bureau

McCormick Place Complex—site of the Federation's 70th Annual Meeting and 57th Paint Industries' Show



"New Directions for a Changing World"

Looking towards the future, the theme of this year's Annual Meeting Program, "New Directions for a Changing World," focuses on the need to change existing business strategies in formulating products, responding to regulatory and safety demands, and prudent management of resources. The "new directions" being addressed in presentations include adopting merging and emerging technologies to drive innovation, developing environmentally friendly products and processes, and embracing total quality systems to effectively compete in a global market.

Under development are the following program session themes:

- Advanced Topics
- Formulation Factors for the Design of Corrosion-Resistant Direct-to-Metal Coatings (DTM)
- Material Quality
- Employee Involvement—Overcoming the Obstacles to Empowerment
- Waste Minimization
- Merging/Emerging Technologies
- Roon Award Competition Papers

Additional topics will feature presentations on:

- Powder Coatings
- Pigments for High Performance Coatings
- Wood Finishing
- Recycling
- EB Curing Systems
- Waterborne Paint Systems
- Corrosion Inhibitors
- Low VOC Coatings
- Paint Filtration
- Epoxy Resins
- Adhesion Promoters

Highlighting the technical program will be the Mattiello Memorial Lecture by Dr. John L. Gardon, of AKZO Coatings, Inc., Detroit, MI. Dr. Gardon's presentation will be made during the Friday morning session. The Keynote Address, scheduled for Wednesday morning, will be given by noted columnist, Jack Anderson.

A Poster Session, featuring non-commercial work in new ideas and techniques in coatings research will be held on Thursday in the exhibit hall.

Record-Setting Paint Show to Feature Products of Over 260 Companies

The largest Paint Show in Federation history—indeed, the largest coatings-related exhibition in the world—will be held in conjunction with the Annual Meeting in McCormick Place North. Over 260 supplier companies to the coatings manufacturing industry will be present to discuss their newest products and services. In over 90,000 sq. ft. of exhibits will be displayed a wide variety of raw materials, production equipment, containers and filling equipment, laboratory apparatus, and testing devices for the paint and coatings producer.

Key personnel from the top technical and sales staff will be on-hand to provide attendees with an opportunity to learn of the latest developments in their products and services. Listed elsewhere are the exhibitors who have reserved space in the Paint Industries' Show.

Exhibit hours will be:

10:00 am-5:30 pm ..... Wednesday, October 21
9:00 am-5:30 pm ..... Thursday, October 22
9:00 am-12:00 Noon ..... Friday, October 23

Jane Byrne, Former Mayor of Chicago, to Speak at Federation Luncheon

The annual Federation Luncheon will be held on Friday, October 23, at McCormick Center Hotel. The featured speaker will be Jane Byrne, former Mayor of Chicago. Tickets for the luncheon may be purchased for $25 either in advance by filling in the appropriate information on the registration form or on-site at the Registration Area of McCormick Place North.

Hotel Information

Whether you wish the value of a moderately priced hotel, or the luxury of an upscale property, the choice is yours. The FSCT has arranged for convention rates at seven official Paint Show hotels. All reservations must be placed through the Chicago Convention & Tourism Bureau's FSCT Housing Bureau to obtain the preferred rates. A confirmation will be mailed from the Bureau.

Deposits

A $100 deposit per guest room and $300 deposit per suite is required in order to process requests. This is a refundable deposit. The following methods of payment are acceptable: checks made payable to the FSCT Housing Bureau or credit cards. Credit card choices include American Express, Mastercard, or Visa. Please note that the deposit will be applied immediately to the credit card used.

Deadlines

Reservations must be placed by September 18 to obtain the convention rates. After September 18, call the hotel directly.

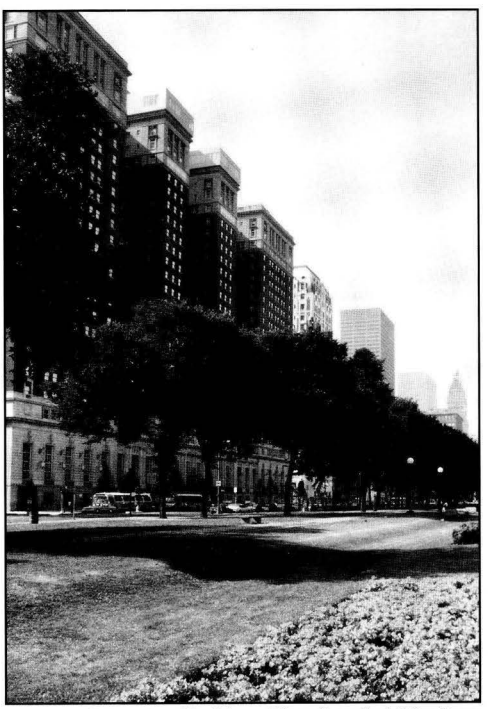


Photo courtesy of Ron Schramm/Chicago Convention & Visitors Bureau

The Chicago Hilton—headquarters hotel for the FSCT Annual Meeting & Paint Industries' Show

Changes/Cancellations:

For changes or cancellations prior to September 18, call the FSCT Housing Bureau at 312-567-8507 or fax your change to 312-567-8577. After September 18, call the hotel directly.

Do it Your Way and $ave!

You have the convenience of placing a phone call, mailing, or faxing your request for hotel accommodations to the FSCT Housing Bureau.

Call! 800-723-2000 or 312-567-8507

Have the information requested on the Hotel Reservation Form available before you place your call. Reservationists are available 8:30 a.m. - 6:30 p.m., Monday through Friday, Central Standard Time. Reservations will be immediately confirmed over the phone and also by mail.

Fax! 312-567-8577

Anytime, any day. Fax the Hotel Reservation Form at your convenience. Be sure to include a phone number and retain your copy of the form for your records. Confirmations will be sent via fax within one working day of receipt of request.

Mail!

Send your form to the FSCT Housing Bureau for processing. Be sure to include a phone number and keep a copy of the form for your records. Your confirmation will be mailed.

Airline Information

The Federation's Travel Desk has negotiated super deals on United and USAir to Chicago featuring up to 40% discounts. To make your transportation arrangements to the Paint Show, call the FSCT Travel Desk at 1-800-448-FSCT or 215-628-2549 and mention "Paint Show 92." An agent will make your reservations, write your tickets using your credit card number, and mail the tickets directly to you.

or

Call the official carriers directly. Be sure to reference the file numbers provided:

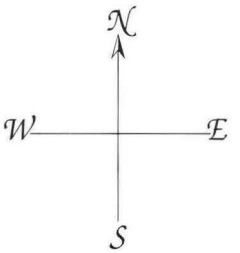
USAir 1-800-334-8644
REFERENCE Gold File#62330000

United* 1-800-521-4041
REFERENCE Meeting Code: 533GU

* Seven day advance purchase required.

For each airline, certain restrictions may apply.

Participating Hotels



Chicago Hilton and Towers (headquarters)

Luxury property located on Grant Park and five minutes from McCormick Place. Shuttle service, twenty-four hour coffee shop and room service. Fine dining at Buckingham's, Kitty O'Sheas Irish Pub, Fast Lane Deli plus entertainment in Lakeside Green Lounge. Special Towers accommodations for business travelers. Services include: health club with indoor pool, business center, drug store, unisex hair salon, boutiques and indoor parking garage.

312-922-4400

(Requests for rooms limited to 10 per company)

Hyatt Regency Chicago

Thirty six-story, twin-tower hotel with 10 restaurants and lounges. Located on the Chicago River and at the beginning of Chicago's Magnificent Mile, offering immediate access to shopping, entertainment, parks, museums, and other cultural attractions.

312-565-1234

McCormick Center Hotel

Features newly remodeled guest rooms. Connected to McCormick Place North by covered pedestrian walkway. Hotel operates three restaurants, complimentary indoor pool and full service health club.

312-791-1900

(Requests for rooms limited to 10 per company)

Palmer House Hilton

Historic hotel with newly restored guest rooms in downtown location. Five blocks to the Chicago Hilton and over 50 restaurants nearby. Deluxe category hotel, featuring five restaurants, fitness center, business center and ticket/tour desk. (NPCA headquarters.)

312-726-7500

Executive Plaza Hotel

The Executive Plaza Hotel is conveniently located just west of Michigan Avenue, at the Chicago River. Walk to the finest restaurants, night clubs, and Chicago's most popular attractions. Large guest rooms feature a separate seating area, work area, remote control TV, mini bar, coffee maker, and clock radio...additional services include multi-lingual concierge staff, exercise facility and business center.

312-346-7100

Essex Inn on Grant Park

Across from Grant Park and close to the FSCT headquarters hotel. Free courtesy shuttle downtown. New York style deli and lounge. Outdoor heated pool. Free parking for guests. Airport limousine service.

312-939-2800

Stouffer Riviere Hotel

New hotel located at the corner of State St. and Wacker Dr. overlooking the Chicago River. Within walking distance to Chicago's business, culture and shopping districts. Guests enjoy complimentary coffee, newspaper, with wake up call. Complimentary shoeshine service, complimentary health club.

312-372-7200

Useful Phone Numbers

Federation's Travel Desk 1-800-448-FSCT
or 215-628-2549
Reference: "Paint Show 92"

USAir: 1-800-334-8644, Ref. Gold File #62330000.

United: 1-800-521-4041, Ref. Meeting Code 533GU.

FSCT Housing Department 800-723-2000
312-567-8507

Dates to Remember

Hotel Reservations (deadline) ..... September 18

Advance Registration (deadline) ..... September 18

Annual Meeting & Paint Show ..... October 21-23

*Hotel Room and Suite Rates**

Code	Property	Singles	Doubles/Twins	1 BR Suite *	2 BR Suite *
#111	Chicago Hilton Hotel	$120,145,175	$145,155,185	$395-560	$525-735
#119	Chicago Hilton Towers	$210	$225	$450-675	$665-895
#113	Hyatt Regency Chicago	$142	$162	$356-2500	$507-2690
#110	McCormick Center Hotel	$129,145	$149,165	$375-504	$673-1200
#112	Palmer House Hilton	$115,130,145	$130,145,160	$295-710	$615-865
#107	Executive Plaza Hotel	$110	$125	$175	$250
#106	Essex Inn on Grant Park	$96	$108		
#116	Stouffer Riviere Hotel	$145	$165	$450 & up	$550 & up

*Rates do not include 12.4% hotel tax. (Subject to change.)
Requests for rooms at the Chicago Hilton and Towers and McCormick Center Hotel will be limited to 10 rooms per company.
Room Type Key: Single (1 person, 1 bed); Double (2 people, 1 bed); Twin (2 people, 2 beds); 1BR Suite (parlor + 1 bedroom); 2 BR Suite (parlor + 2 bedrooms).

Shuttle Service

Shuttle Bus service will be provided between the cooperating hotels* and the McCormick Place North. The routes and schedules are listed below.

Route 1

Chicago Hilton—
8th Street Entrance

Essex Inn on Grant—
Walk to Chicago Hilton

Palmer House—
Wabash Avenue Entrance

Route 2

Executive Plaza Hotel—
Wacker Drive

Stouffer Riviere Hotel—
Walk to Executive Plaza Hotel

Hyatt Regency Chicago—
Wacker Drive Eastbound

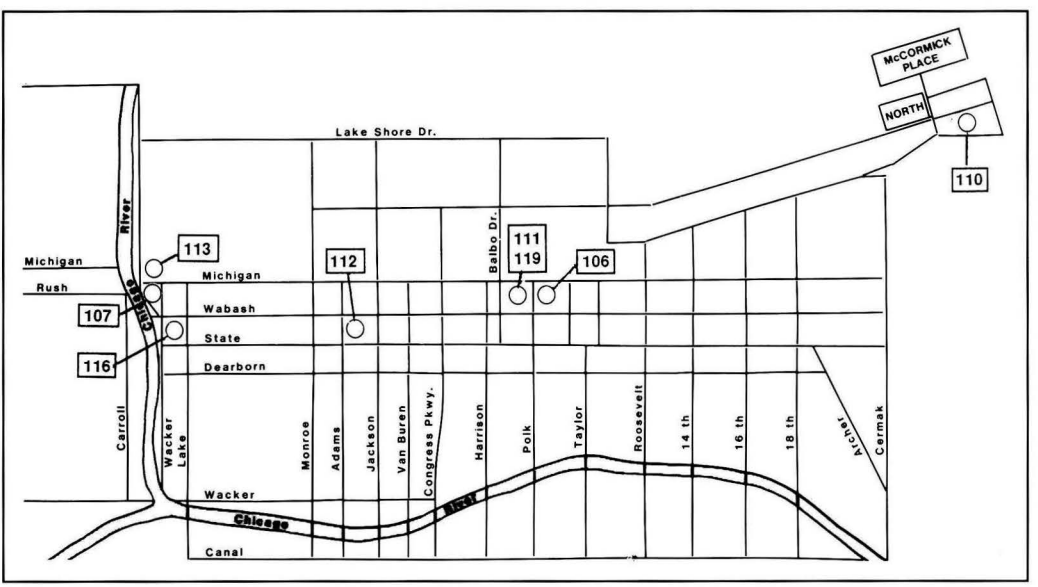
Shuttle Schedule
Hours of Operation

Tuesday, October 20—
8:00 am - 8:30 pm

Wednesday, October 21—
7:30 am - 6:30 pm
6:30 - 12 midnight*
*(Shuttle service between the cooperating hotels and the Chicago Hilton)

Thursday, October 22—
7:30 am - 6:30 pm

Friday, October 23—
7:30 am - 3:00 pm



1992 FSCT Annual Meeting and Paint Industries' Show
McCormick Place North
Wednesday, Thursday, and Friday, October 21-23, 1992

HOTEL RESERVATION FORM

MAIL FORM & DEPOSIT TO:

FSCT Housing Bureau
c/o Chicago Convention & Tourism Bureau
McCormick Place on the Lake
2301 South Lakeshore Dr.
Chicago, IL 60616

PHONE/FAX:

(800) 723-2000 Continental U.S.
& outside Chicago
(312) 567-8507 Outside the U.S.
FAX: 312-567-8577

HOTEL PREFERENCE

List the three digit code of your preference. First choice will be assigned if available. List other preferences to avoid delay. If your first choice is not available, your deposit will be applied to your next available choice. The deadline is September 18.

1) ☐☐☐ _____ 2) ☐☐☐ _____ 3) ☐☐☐ _____
Code Hotel Code Hotel Code Hotel

RESERVATION REQUEST

Names of Occupants	Room Type	Rate	Arrival	Depart

For additional reservations, feel free to copy this form.
Requests for the Chicago Hilton and McCormick Center Hotel will be limited to 10 rooms per company.

METHOD OF PAYMENT

Deposit Required. No form will be processed without a deposit. Credit cards will be billed immediately for first nights deposit

Credit Card (American Express, Mastercard, or VISA only.) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ Expiration Date: ☐☐/☐☐ Signature _____

or Check made payable to: "FSCT Housing Bureau" $ _____ Check No. _____

MAIL ALL CONFIRMATIONS TO:

Name: _____ Telephone: _____
Company: _____ FAX: _____
Address: _____
City/State (Province): _____ Zip Code (Mailing Code): _____
Country (if other than U.S.): _____

If requested room rate is not available, the nearest rate will be assigned by the FSCT Housing Bureau. We cannot guarantee that the accommodations will be assigned in your preferred hotels.

☐ _____ is handicapped and requires special assistance. Phone: _____
Name

HOW TO MAKE YOUR ARRANGEMENTS

1. To place AIRLINE reservations, call the Federation's Travel Desk at 1-800-448-FSCT or 215-628-2549 and mention "Paint Show 92". To contact carriers directly, call the following numbers and reference the file numbers provided: US Air: 1-800-334-8644, Ref. Gold File #62330000. United: 1-800-521-4041, Ref. Meeting Code 533GU.

2. To make HOTEL reservations, mail or fax the housing application to the FSCT Housing Department. Housing cut-off date is September 18.

3. REGISTER IN ADVANCE for the Annual Meeting and Paint Industries' Show by filling out the form and mailing it as instructed with your registration payment.

4. To register your SPOUSE or GUEST, fill out the spouse portion of the advance registration form.

5. Mark OCTOBER 21-23 on your calendar. Don't forget — you get a discount if you register by September 18.

Registration Instructions

Advance register to attend the 1992 Annual Meeting and Paint Industries' Show by filling out and mailing the registration form and fees to the FSCT Headquarters Office.

The registration options are listed below. Advance registration forms must be received by September 18.

Register in Advance and SAVE!

Full Time	Advance	On-Site
Member	$65	$75
Non-member	$80	$95
Spouse	$50	$60

Advance Registration

If you register in advance you may pick up your badge at the McCormick Place North Registration Area during the following hours:

Tues., Oct. 20 ..... 8:00 am - 5:00 pm
Wed.-Thurs., Oct. 21-22 ..... 7:30 am - 5:30 pm
Fri., Oct. 23 ..... 7:30 am - 12:00 noon

On-Site Registration

Register at McCormick Place North.

Tues., Oct. 20 ..... 8:00 am - 5:00 pm
Wed.-Thurs., Oct. 21-22 ..... 7:30 am - 5:30 pm
Fri., Oct. 23 ..... 7:30 am - 12:00 noon

Cancellation and Refund Policy

All cancellations must be submitted in writing to the FSCT Headquarters Office. Cancellations received by October 16 will be subject to a $10 handling charge. A $25 charge will be made after that date.

Hotel Reservation Instructions

(1) Reservations must be placed by September 18. Reservations may be phoned, faxed or mailed to the FSCT Housing Bureau.

(2) Confirmations will be mailed from the Housing Bureau. Please allow 30 days for receipt of confirmation.

(3) A one-night's deposit **must** accompany each reservation request. Requests will not be processed without deposit or credit card. Acceptable payments include: personal check, bank draft, and certified check. Checks should be made payable to FSCT Housing Bureau. Credit cards may be used.

(4) Keep a photocopy of your housing request.

(5) Prior to September 18, all changes must be made through the FSCT Housing Bureau. After September 18, all changes should be made directly with the Bureau, subject to availability.

Airport & City Transportation

From Midway Airport

Airport Shuttle (service to downtown hotels, provided by Continental Air Transport) ..... $9.50 one way, $16.75 round trip
Limousine $45
Taxi $20-22

From O'Hare International Airport

Airport Shuttle (service to downtown hotels, provided by Continental Air Transport) ..... $12.50 one way, $22.00 round trip
Limousine $45
Taxi $20-22

(There is also CTA subway service from O'Hare to the Loop on a 24-hour basis, seven days a week. Board trains on the lower level of Terminal 4. The fare is $1.00 and the ride takes approximately 34 minutes.)

To get around Chicago, taxis are readily available throughout the downtown and near north areas. You'll find most of Chicago's best-known restaurants and entertainment are near downtown hotels. The public transportation system runs 24 hours a day, and routes are clearly posted on CTA vehicles, bus stops, and at subway and El stations. If you have a question about modes of transportation, ask the concierge or front desk personnel at your hotel.

1992 Advance Registration

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
492 Norristown Rd., Blue Bell, PA 19422-2350

C	Office Use Only
U	Date Received _____
V	Amount $ _____
	Check No. _____

Please fill out this form and mail with a check in the correct amount (made payable to the FSCT) **to the Federation address shown above.** All checks must be payable in U.S. Funds. Any that are not will be returned. DEADLINE DATE FOR ADVANCE REGISTRATION IS **SEPTEMBER 18**. NONE WILL BE ACCEPTED AFTER THAT DATE.

NO CREDIT CARDS WILL BE ACCEPTED. NO FAXES WILL BE ACCEPTED.

INDUSTRY REGISTRATION FEES:

A ☐ **MEMBER** **$65.00**

Please name the Federation Society in which you are a paid-up member:

_____
Federation Constituent Society

B ☐ **NON-MEMBER** **$80.00**

G ☐ **SPECIAL FEE FOR RETIRED MEMBERS** **$25.00**

_____
Federation Constituent Society

INFORMATION FOR REGISTRATION BADGE:

NICKNAME

FIRST NAME LAST NAME

COMPANY

STREET

CITY STATE *(U.S. only)* POSTAL CODE

COUNTRY *(OTHER THAN U.S.)* TELEPHONE NO.

BUSINESS CLASSIFICATION DATA FOR THE ABOVE REGISTRANT:

YOUR COMPANY (CHECK ONE BLOCK)

- AA ☐ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants
- BB ☐ Manufacturers of Raw Materials
- CC ☐ Manufacturers of Equipment and Containers
- DD ☐ Sales Agent for Raw Materials + Equipment
- EE ☐ Government Agency
- FF ☐ Research/Testing/ Consulting
- GG ☐ Educational Institution Library
- HH ☐ Paint Consumer
- JJ ☐ Other

YOUR POSITION (CHECK ONE BLOCK)

- KK ☐ Management/ Administration
- LL ☐ Manufacturing and Engineering
- MM ☐ Quality Control
- NN ☐ Research and Development
- PP ☐ Technical Sales Service
- QQ ☐ Sales and Marketing
- RR ☐ Consultant
- SS ☐ Educator/Student/ Librarian
- TT ☐ Other

SPOUSES REGISTRATION AND INFORMATION FOR REGISTRATION BADGE:

D ☐ **SPOUSE** **$50.00**

NICKNAME

FIRST NAME LAST NAME

CITY STATE *(U.S. only)* POSTAL CODE

SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:

H ☐ **$25.00**

TICKETS FOR FEDERATION LUNCHEON, FRIDAY, OCTOBER 23 (@$ 25.00)

☐ **NUMBER REQUIRED:** _____
$25.00 EACH.

A $10.00 CHARGE WILL BE MADE FOR CANCELLATIONS RECEIVED PRIOR TO OCTOBER 16. A $25.00 CHARGE WILL BE MADE FOR CANCELLATIONS RECEIVED AFTER THAT DATE.

1992 PAINT INDUSTRIES' SHOW

Current List of Exhibitors

ACS/C&E News
ACS/Industry Relations
Aceto Corp.
Advanced Coatings Technologies
Advanced Software Designs
Agglo Recovery, Inc.
Air Products & Chemicals, Inc.
Ajinomoto U.S.A., Inc.
Akzo Chemicals & Resins
Alcan-Toyo America, Inc.
Alcoa Industrial Chemicals
Allied-Signal Corp.
Alt-Chem International
Ambrose Co.
American Cyanamid Co.
American Iron & Steel Institute
Amoco Chemical Co.
ANGUS Chemical Co.
Anker Labelers USA, Inc.
Aqualon Co.
Arco Chemical Co.
Ashland Chemical, Inc. IC&S Div.
Atlas Electric Devices Co.
Aztec Catalyst Co.

B&P Environmental Resources
B.A.G. Corp.
BASF Corp.
T.J. Bell, Inc./Erichsen Instruments
Blackmer Pump, Dover Resources
Bohlin Instruments, Inc.
Brookfield Engineering Labs., Inc.
Brookhaven Instruments Corp.
Buckman Laboratories, Inc.
Buhler, Inc.
Bulk Lift International, Inc.
Burgess Pigment Co.
BYK-Chemie USA
BYK-Gardner, Inc.

C B Mills, Inc.
CR Minerals Corp.
Cabot Corp., Cab-O-Sil & Special Blacks Div.
Caframo Ltd.
Calgon Corp., Div. of Merck & Co.
Cappelle, Inc.
The Carborundum Co.
Cardolite Corp.
Cargill, Inc.
Carri-Med Americas, Inc.
Carroll Scientific, Inc.
Celite Corp.
Chemical Marketing Reporter
Chemical Week
CIBA-GEIGY Corp.
Coatings Magazine
Color Corp. of America
Colorgen, Inc.
Colortec Associates
Columbian Chemicals Co.
Consolidated Research, Inc.
Cookson Pigments, Inc.
Coulter Corp.
Cray Valley Products, Inc.
Crosfield Chemicals, Inc.
Cuno Process Filtration Products
Cyprus Industrial Minerals Co.

D/L Laboratories
DSA Consulting, Inc.
Daniel Products Co.
Dantco Mixers Corp.
Datacolor International
Day-Glo Color Corp.
Defelsko Corp.
Degussa Corp.
University of Detroit Mercy
Distil-Kleen, Inc.
Dominion Colour Corp.
Dow Chemical USA
Dow Corning Corp.
Draiswerke, Inc.
Drew Industrial Div.
Dry Branch Kaolin Co.
Du Pont Co.

ECC International
EM Industries, Inc.
EMCO Chemical Distributors Inc.
Eagle Picher Minerals, Inc.
Eagle Zinc Co.
Eastern Michigan University
Eastman Chemical Co.
Ebonex Corp.
Eiger Machinery, Inc.
Elektro-Physik USA, Inc.
Elf Atochem
Elmar Worldwide
Engelhard Corp.
Epworth Manufacturing Co., Inc.
Etna Products Inc.
Exxon Chemical Co.

FMC Corp., Food & Pharmaceutical Prod. Div.
Fawcett Co., Inc.
Federation of Societies for Coatings Technology
Filter Specialists, Inc.
Fischer Technology, Inc.
Fluid Management Ltd. Partners
FMJ International Publications Ltd.
Freeman Polymers
H.B. Fuller Co.

Paul N. Gardner Co., Inc.
B.F. Goodrich Co., Spec. Polym. & Chem. Div.
Goodyear Tire & Rubber Co.,
W.R. Grace & Co., Davison Chemical Div.
Guer-Tin Bros. Polymers

Halox Pigments, Div. of Hammond Lead Products
Harcros Pigments, Inc.
Henkel Corp., Coatings & Inks Div.
Heraeus DSET Laboratories, Inc.
Heucotech Ltd.
Hilton-Davis Co.
Hitox Corp. of America
Hockmeyer Equipment Corp.
Hoechst Celanese Corp., Pigments Div.
Hoechst Celanese Corp., Waxes & Lubricants Group
Horiba Instruments, Inc.
J.M. Huber Corp.
Hüls America, Inc.
Hunterlab

ICI Americas, Inc.
ICI Resins U.S.
ISP Filters, Inc.
ITT Marlo Pumps
Ideal Manufacturing & Sales
Industrial Finishing Magazine
Interfibe Corp.
International Compliance Center
International Resources, Inc.
International Specialty Products
S.C. Johnson Polymer
Journal of Coatings Technology

KTA-Tator, Inc.
K-T Feldspar Corp.
Kemira, Inc.
Kenrich Petrochemicals, Inc.
Kent State University
King Industries, Inc.
KRONOS, Inc.

Lawter International
Leeds & Northrup, Microtrac Div.
LeSac Corp.
Lightnin
Liquid Controls Corp.
The Lubrizol Corp.

3M, Industrial Chemical Prod. Div.
Macbeth, Div. of Kollmorgen Corp.
Magnesium Elektron, Inc.
Malvern Instruments
Malvern Minerals Co.
Matec Applied Sciences
McWhorter, Inc.
The Mearl Corp.
Michelman, Inc.
Micro Powders, Inc.
Microfluidics Corp.
Micromeritics Instrument Corp.
Miles Inc.
Millipore Corp.
Mineral Pigments
MiniFibers, Inc.
Minolta Corp.
Mississippi Lime Co.
University of Missouri-Rolla
Modern Paint & Coatings
Morehouse Cowles, Inc.
Morton International/Universal Color Dispersions
Mountain Minerals Co., Ltd.
Myers Engineering

NYCO Minerals, Inc.
Nacan Products Ltd.
National Chemical Co.
Netzsch Incorporated
Neupak, Inc.
Neville Chemical Co.
New Way Packaging Machinery
Nicolet Instrument Corp.
Nippon Shokubai Co., Ltd.
North Dakota State University

Obron Atlantic Corp.
Ohio Polychemical Co.
Olin Chemicals
ORTECH International

PPG Industries, Inc., Silica Products
PPG Industries, Inc., Specialty Chemicals
PQ Corp.
Pacific Micro Software Engineering
Paint & Coatings Industry Magazine
Peninsula Polymers
Pen Kem, Inc.
Pfizer Specialty Minerals
Philips Container Co.
Physica USA
Pico Chemical Corp.
Plastican, Inc.
Polar Minerals
Pollution Control Industries
Poly-Resyn, Inc.
Premier Mill Corp.
Progressive Recovery, Inc.
Pyosa, S.A. de C.V.

The Q-Panel Co.
The Quackenbush Co.
Quantachrome Corp.

Raabe Corp.
Ranbar Technology Inc.
Reichhold Chemicals, Inc.
RHEOX, Inc.
Rhône-Poulenc Inc.
Rohm and Haas Co.
Rosedale Products, Inc.
Charles Ross and Son Co.
Russell Finex Inc.

SCM Chemicals
Sandoz Chemicals Corp.
Sanncor Industries, Inc.
Sartomer Co. Inc.
Schold Machine Corp.
Scott-Bader
Semi-Bulk Systems, Inc.
Serac, Inc.
Shamrock Technologies, Inc.
Shell Chemical Co.
Sherwin-Williams Chemicals Co.
Shimadzu Scientific Instruments
Silberline Manufacturing Co.
Sino-American Minerals, Inc.
Sloss Industries Corp.
South Florida Test Service, Inc.
Southern Clay Products, Inc.
University of Southern Mississippi
Spartan Color Corp.
Startex Chemical Co.
Steel Structures Painting Council
Sub-Tropical Testing Service
Sun Chemical Corp.
Systech Environmental Corp.

Tego Chemie Service USA
Teledyne Taber
Texaco Chemical Co.
Thiele Engineering Co.
Tioxide, Inc.
Troy Corp.

U.S. Borax
U.S. Silica Co.
Unimin Specialty Minerals Inc.
Union Carbide Corp.
Union Process, Inc.
United Catalysts, Inc., Rheo. & Perf. Minerals Group
United Mineral & Chemical Corp.
United States Testing Co., Inc.

Van Waters & Rogers
R.T. Vanderbilt Co., Inc.
Velsicol Chemical Corp.
Versa-Matic Tool, Inc.
Viking Pump, Inc., a Unit of Idex
Vorti-Siv., Div. of M&M Industries

Wacker Silicones Corp.
Wallon Machinery, Inc.
Warren-Rupp, Inc., a Unit of Idex
Wilden Pump & Engineering Co.
Witco Corp.

X-Rite, Inc.

Zeelan Industries, Inc.

Columnist Jack Anderson to Give Keynote Address at Annual Meeting

Noted columnist Jack Anderson will present the Keynote Address at Wednesday's Opening Session at the FSCT 70th Annual Meeting. With his *Merry Go Round* column appearing in over 1000 newspapers daily, Anderson is the most widely syndicated columnist in the world. Additionally, he is a regular contributor to *The Real Story*, CNBC's nightly live information-based show; a daily radio commentator for UPI Radio Network's 1100 stations; the best-selling author of numerous books (the most recent being *Stormin' Norman*); and the most dynamic speaker on the nation's lecture circuit.

It was from his column that we first heard of the Savings and Loan scandal, the Iran/Contra Arms-for-Hostages deal, and the danger of Saddam Hussein. Anderson fascinates and educates audiences with his insights and inside stories—always standing for the public's right to know.

Spouses to Tour Chicago Sites

Spouses Activities begin on Wednesday, October 21, with a wine and cheese social in the Chicago Hilton Hotel.

On Thursday, following a continental breakfast in the Chicago Hilton, registered spouses will depart on deluxe motorcoaches for the Art Institute of Chicago and the John G. Shedd Aquarium.

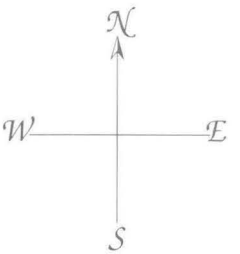
To enhance the viewing of the Art Institute's magnificent collection, spouses will receive a private lecture on "Highlights of the Art Institute of Chicago." The monumental stained-glass America Window by Chagall, and the great gilded Trading Room of Chicago's famous Stock Exchange Building will be among the highlights. After the presentation, spouses will have ample time to view the galleries.

Chicago's newest attraction, the Oceanarium at the Shedd Aquarium, will also be included in the tour. The Oceanarium is the world's largest indoor marine pavilion. Home to the Harbor Seals, Sea Otters, and Rockhopper Penquins, the Oceanarium features an elaborate re-creation of the Pacific Northwest temperate rain forest habitat. Spouses will stroll through scenic nature trails to an amphitheater where the Oceanarium staff will demonstrate the behaviors of beluga whales and white side dolphins.

A delicious luncheon will be served at the Mid-America Club located atop one of the tallest buildings in Chicago, offering a spectacular view of the Chicago skyline.

Comfortable walking shoes are recommended.

The tour limit is 650. Advance registration for the spouses activities is recommended.



FSCT Board of Directors to Meet On Tuesday at Chicago Hilton

The Board of Directors of the Federation will meet on Tuesday, October 20, at 9:00 am in the Chicago Hilton Hotel.

NPCA Annual Meeting Same Week

The National Paint & Coatings Association will hold its annual meeting on October 19-21, 1992, at the Palmer House, in Chicago.

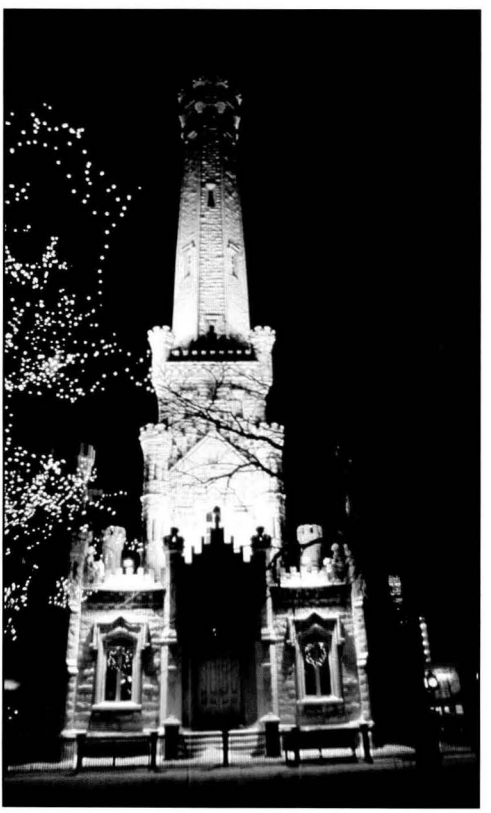


Photo courtesy of Ron Schramm/Chicago Convention & Tourism Bureau

Chicago's famous landmark— Water Tower Place

California Spray-Paint Tax Initiative Falls Short; Chicago City Council Votes to Ban Sale of Aerosol Paints

The National Paint and Coatings Association (NPCA), Washington, D.C., has reported that the proponents of a $1-per-can sales tax on spray paints in California have been defeated after failing to get the necessary signatures to place their initiative on the ballot.

According to officials at NPCA, "anti-graffiti and gang prevention" sales tax initiative could have cost the industry an estimated $40 million in sales annually.

Citizens' War on Graffiti and Gangs, the group responsible for sponsoring the measure, admitted to not collecting the required number of signatures, by the April deadline, necessary for placing the initiative on the ballot. The group conceded that an "anti-tax sentiment" among California voters along with " . . . the paint industry's relentless activities . . . provided an additional obstacle."

However, members of the Citizens' War on Graffiti and Gangs have stated that they will continue their efforts, either by pursuing a ballot initiative next year or by seeking legislation this year in the state legislature.

In other news regarding the sale of aerosol paints, NPCA has announced that members of the Chicago, IL, City Council voted in May to ban the sale of spray paint within the city limits. According to NPCA, the Chicago City Council announcement came as a shock to both the paint industry and the public.

The Chicago Council's attempt to ban spray-paint sales is in response to frustration with the proliferation of graffiti in the city. Officials at NPCA have noted that the industry has been working closely with the city of Chicago in its war on graffiti, and contributed an estimated 20,000 gallons of paint in 1991 to cleanup efforts. Also, the paint industry has offered a "responsible retailing" program to help retail outlets eliminate spray-paint sales to minors.

Spray paint and related sales in Chicago amount to over $15 million a year. Loss of these sales means not only the loss of over $1 million in sales tax, but perhaps more importantly, the loss of over 100 retail jobs in Chicago.

NPCA has reported that the ordinance cannot take effect for 60 days after passage by the City Council. This action leaves the paint industry only a limited opportunity to try to prevent the adoption of the ordinance.

Representatives of NPCA's Spray Paint Manufacturers Committee, the Illinois Paint Council, and the Western Aerosol Information Bureau have met to discuss industry strategies.

Officers at NPCA have stated that they "would like Chicago Mayor Richard Daley to veto the bill, by suggesting that not only is a spray paint ban a band-aid approach, but that there are proven, more effective ways to attack graffiti vandalism."

NPCA has initiated litigation to set aside the ordinance.

On a more positive note, NPCA announced that the Puget Sound Paint and Coatings Association helped bring Christmas in April to 20 homeowners in the Seattle, WA area.

Seattle's Christmas in April project, sponsored with the aid of several community organizations, saw the Puget Sound group donate interior and exterior paint for homes of low-income, elderly residents. In addition to the paint donation, approximately 50 members of the group joined forces with 600 community volunteers to do the necessary painting, repair work, and yard cleanup. The Puget Sound members were assigned to repaint the interior and exterior of two homes.

The Puget Sound paint industry participated in this project as part of its annual "Picture It Painted" community service campaign.

Construction Contracting for March Falls Nine Percent; First Quarter Contract Values Ahead of 1991 Totals

The total of contracting for new construction for March fell nine percent from February's total according to the F.W. Dodge Division of McGraw-Hill, Inc., New York, NY.

Officials at the Dodge Division have reported that "the opening three months of 1992 brought the fourth in a series of small but steady quarterly gains." At the end of the first quarter of 1992, the unadjusted total of newly started construction of all kinds was at $54.2 billion, 16% greater than the value reported for the same time period in 1991 ($46.8 billion). For the quarter, housing was up 35% (from $17.6 billion in 1991 to $23.8 billion in 1992), and "nonbuilding" construction was up 24% (from $10.2 billion in 1991 to $12.6 billion in 1992), the primary reason for the year-to-date improvement.

Nonresidential building remained 7% behind 1991's first quarter total ($19 billion in 1991 compared to $17.8 billion in 1992) due to the still-depressed commercial real estate market. Contracting for nonresidential buildings declined 16% in March (from $90.1 billion in February to $75.7 billion in March).

Contracts for residential buildings ($110.1 billion) and for nonbuilding construction ($56.3 billion) both fell 5% in March. However, they were both well ahead of 1991's depressed levels for the same time period. Sources at McGraw-Hill have indicated that lower mortgage rates, in the case of housing, and a new and much expanded highway program, are two reasons they expect continued strength in these categories.

At the close of first quarter, all five major regions of the nation showed substantial improvement over 1991's construction activity. The largest percentage gains were reported in the Northeast (20%), North Central (29%), and South Central (18%). Below average gains were confined to the West (10%) and South Atlantic (7%).

For more details, contact Mark Danes, McGraw-Hill, Inc., 1221 Avenue of the Americas, New York, NY 10020.

Mearl International Expands Facilities and Laboratories

Mearl International BV, Haarlem, Holland, recently completed a major expansion of its offices, warehousing facilities, and laboratories.

The expansion of the Mearl Holland complex has: doubled the size of warehousing storage facilities; expanded the executive offices for the European staffed sales, technical marketing, and customer service groups; and upgraded and expanded laboratories and equipment for the testing, evaluation, and application of luster pigments.

Picture It Painted Professionally Contest Honors Painting and Decorating Contractors

The 1991 "Picture It Painted Professionally" award-winning contractors were honored during the Painting & Decorating Contractors of America (PDCA) annual convention held in March, in Las Vegas, NV. The contest is cosponsored by the National Paint and Coatings Association, Washington, D.C.

The competition, which celebrated its 10th anniversary by honoring 12 painting and decorating contractors from across the country, recognizes outstanding skill and creativity with paint.

As part of the 10th anniversary, the contest was open to include professional contractors outside of the PDCA membership for the first time in its history. As a result, the competition generated a total of 73 entries, nearly twice the amount as usual.

The winners are as follows:

INTERIOR RESIDENTIAL: First Place—Frogmoor Room, Karl Heinz Meschbach Decorative Painting, Circle Pines, MN; Second Place—Wolf Residence, Prime Enterprises, Laurel, MD; and Third Place—Sturgis Home, Designs in Partnership, Palatine, IL.

EXTERIOR RESIDENTIAL: First Place—Blumenfeld House, O'Brien Painting, Petaluma, CA; Second Place—Sacramento Street Residence, Cal Crew Painting, San Rafael, CA; and Honorable Mention—Harmony Lane and Main Street Residence, L&M Painting, Paperhanging, and Decorating, Ridge, NY.

INTERIOR COMMERCIAL: First Place—Temple Sherith Israel, Traditional Painting & Decorating Ltd., San Francisco, CA; Second Place—Michigan State Capitol, Genesee Painting Company, Inc., Flint, MI; Honorable Mention—Sheraton Palace Hotel, W.G. Thompson Inc., Point Richmond, CA.

EXTERIOR COMMERCIAL: First Place—Gas Company Tower, Architectural Wallcovering Installations, Inc., Phoenix, AZ; and Second Place—Christ the King Ukranian Catholic Church, Theodore Hooven Sons, Inc., Havertown, PA.

INDUSTRIAL: First Place—Federal Street Conrail Bridge, Delbert L. Smith Company, McKees Rocks, PA; and Second Place—Chevrolet-Pontiac-Cadillac Group, Flint Engine Plant, and Truck and Bus Assembly Plant, Genesee Painting Company, Inc.

The projects were judged by an independent panel of industry representatives on the basis of four criteria: use of color, use of special painting techniques, creativity, and overall skill and execution.

Shell Chemical to Expand Kraton G Polymer Capacity

Shell Chemical Company, Houston, TX, a division of the Houston-based Shell Oil Company, plans to expand its Kraton® G Polymer capacity by 20% at its Belpre, OH plant.

According to officials at Shell, the new capacity is expected to be onstream by the end of 1994, and additional debottlenecking to further increase capacity is being planned for the 1995-97 timeframe.

Also, Shell Chimie, an affiliated company of the Royal Dutch Shell Group, has begun construction of a new Kraton G facility at Berre, France. The plant is scheduled for start-up by mid-1994. It will have a capacity of approximately 20,000 tons per year.

Akzo Coatings Inc. Restructures North American Operations Into Five Business Units; Managerial Appointments Announced

Akzo Coatings Inc., Louisville, KY, has restructured its North American coatings operations into business units.

The restructuring follows the recent reorganization of Akzo's European coatings operations into business units, and Akzo nv's restructuring of its top management in Arnhem, The Netherlands.

H.C. (Kees) Bijvank, Executive Vice President of the Coatings Division worldwide and a member of the Akzo Coatings Executive Committee, will manage the implementation of the reorganization. He will serve as interim President and Chief Executive Officer of Akzo Coatings Inc.

Akzo Coatings has been restructured into five business units: General Industrial Coatings, Resins, Decorative, Car Refinishes (including sign coatings), and Industrial Wood Coatings. These business units will be supported by necessary service units in the functional areas such as (but not limited to) human resources, finance, health, safety and environmental, and research and development.

The General Industrial Coatings Business Unit will consist of the following market sectors: aerospace, automotive OEM, can, coil, paper, plastic, and other miscellaneous industrial coatings.

Recently appointed business unit managers include:

Herbert A. Champlin—General Industrial Coatings;

Gary L. Fulk—Industrial Wood Coatings;

George M. Findling—Resins;

Eduardus A. van Rossum—Decorative; and

Larry E. Curry,Car Refinishes.

In addition to these appointments, Robert J. Torba has been named Assistant Business Unit Manager for the General Industrial Business Unit.

News concerning the restructuring and additional management appointments are expected in the next several months.

Mergers & Acquisitions...

Amoco Chemical Opens Fabrics Facility in China

Amoco Chemical Company, Chicago, IL, has announced the start of its first joint-venture investment in the People's Republic of China (PRC).

The Yizheng Amoco Fabrics Company Ltd. joint venture has been formed to produce and market polypropylene fabric products, including intermediate product containers, closeweave bags, primary carpet backing, extrusion coated fabrics, and geotextiles.

The Yizheng Company is owned by Amoco and Yizheng Joint Corporation of Chemical Fibre Industry.

The joint-venture facility is located in the PRC's Jiangsu Province, about 400 miles southeast of Beijing.

Rohm and Haas Purchases Unocal's Polymers Business

The Rohm and Haas Company, Philadelphia, PA has completed the acquisition of the emulsion polymers business of the Chemicals and Minerals Division of Unocal Corporation, Schaumburg, IL. The sale was concluded on May 14.

Included in the transaction are six U.S. manufacturing plants and a state-of-the-art technical center in Charlotte, NC. In a separate but related matter, Rohm and Haas has divested the architectural coatings acrylic polymer portion of the acquisition, which has been sold to Union Carbide Chemicals and Plastics Company, Inc., Danbury, CT.

A staff of technical service representatives dedicated to the industrial and architectural coatings industries will be stationed at the center in Charlotte.

In the architectural coatings area, Rohm and Haas has acquired Unocal's vinyl acrylic and styrene acrylic polymers. Application areas for these polymers are flat and semi-gloss paints, elastomeric wall coatings, primers, and sealers.

Unocal All-Acrylic Latexes Acquired by Union Carbide

The UCAR Emulsion Systems (UES) business of the Union Carbide Corporation, Danbury, CT, has acquired three all-acrylic coating products from Unocal Corporation of Los Angeles.

The purchase includes technology to produce emulsions for the architectural and specialty products markets—segments that typically include house paints, tennis court and traffic coatings, traffic marking paints, and concrete sealers. Customer lists are also included in the transaction.

For transitional purposes, the three emulsions involved in the transaction, designated RES 6004, RES 6034, and RES 6510, will continue to be made at existing Unocal facilities for up to a year. The products ultimately will be made in existing UES manufacturing facilities. No transfer of facilities or equipment is involved in the purchase and the transaction will not have a material financial impact on Union Carbide or Unocal.

Ferro Corp. to Consolidate Powder Coatings Capability

Ferro Corporation, Cleveland, OH, has announced that its powder coating manufacturing capability in Cleveland will be combined with its Nashville, TN operation. The consolidation is expected to be completed by the end of the year.

Ferro will maintain a responsive distribution network in North America with warehouses in Ontario, Canada, Cleveland, and Los Angeles, CA.

It is reported that Ferro will spend approximately $2.5 million to modernize the plant in Nashville to a state-of-the-art powder coatings manufacturing facility. New milling and extrusion technology will be incorporated to improve product quality and increase productivity. The consolidation of the two facilities was scheduled to begin in June.

Unichema International Opens Middle East Office

Unichema International, Chicago, IL, has opened a sales office in the Middle East in Dubai, United Arab Emirates.

The Dubai office has been in operation since February.

The new Unichema International business address is: P.O. Box 49, Dubai, United Arab Emirates.

Four Methods for Predicting the Flash Point of Alkyd Paints Containing VM&P Naphtha and Mineral Spirits–Part I

John L. McGovern
The Testor Corporation*

Four methods are presented for the calculation of the flash points of petroleum distillate blends. Each method is used to calculate the flash points of 30 paints containing VM&P naphtha and mineral spirits. These calculated flash values are shown to compare well with the flash points of the paints determined on a Setaflash OISF instrument.

INTRODUCTION

The requirement of labeling paints as "flammable" or "combustible" entails a determination of the flash point of a paint mixture. If a formulator has measured the flash points of all of a large number of formulations, then he or she knows that it is a time-consuming undertaking. A change in labeling regulations or a formulation change which affects a large proportion of these products can require that these measurements be repeated. A theoretical method of calculating flash points which is accurate, and which therefore, could obviate such a commitment of man-hours, would be a valuable tool to the paint industry.

A method has been conceived for calculating the flash points of alkyd paints, containing as solvents only the petroleum distillates VM&P naphtha and mineral spirits, during the process of measuring the closed cup flash points of all of a large line of paints produced by the Testor Corporation. The method is based upon the thermodynamics of ideal solutions.

The objectives in developing this method were threefold:

(1) To devise a procedure to accurately calculate the flash points of petroleum distillate blends;

(2) To apply the method to the estimation of the flash points of pigmented alkyd resins; and

(3) To apply to the same paints some of the methods found in a literature search which showed good accuracy in estimating flash points of hydrocarbon blends and compare these results to the results obtained by this method.

While exploring the literature on the topic of flash point calculation, I found methods of calculation ranging from easily implemented but theoretically unsound (like Method B which follows), to those which are theoretically more valid but involve quite lengthy calculations, like the UNIFAC method.[1] Some methods are restricted to ideal solutions, like Method B, while others compute activity coefficients and so are applicable to non-ideal solutions, like the UNIFAC method and Walsham method.[2]

Since a mixture of VM&P naphtha and mineral spirits should be nearly ideal (to be discussed in a later section), I did not compute activity coefficients in this application. For this reason, I compared the results of my method to those obtained by three other methods which performed well in computing the flash points of petroleum distillate mixtures and which also do not involve activity coefficients.

PHYSICAL LAWS AND FLASH POINTS

The two factors which determine that a given liquid will produce a flash in a given apparatus at a given temperature and external pressure are its vapor pressure and lower explosive limit.[3]

The lower explosive limit of a solvent is the lowest concentration of the solvent vapor in the air which will ignite when exposed to a flame.

*620 Buckbee St., Rockford, IL 61104.

For mixtures of solvents, two laws govern the flash point behavior[3]: Dalton's Law and LeChatelier's Law.*

Dalton's Law states that the partial vapor pressures of the solvents in the mixture are added to give the total vapor pressure of the solution.

LeChatelier's Law states that a flammable mixture will occur when the summation of all the actual component concentrations in the vapor divided by their respective lower explosive limit concentrations equals 1:

$$\sum_{i=1} Y_i / L_i = 1 \qquad (1)$$

where Y_i is the vapor concentration of component i and L_i is the lower explosive limit concentration of i. Lower explosive limits are usually expressed in volume percent, but they can be expressed in units of pressure since at a given temperature T and 760mm Hg air pressure the volume percent of vapor equals 100 p/760, where p is the vapor pressure of the solvent at temperature T. Thus, we may let L_i be the vapor pressure p_i of the neat solvent i at its flash point, and then the Y_i are given by the respective partial vapor pressures, p_i, of the components of the mixture.

Then LeChatelier's Law is:

$$\sum_{i=1} p_i / p_i^F = 1 \qquad (2)$$

PETROLEUM THINNERS—IDEAL HYDROCARBON MIXTURES

Blends of paraffin solvents exhibit flash point behavior which is in approximate accord with Raoult's Law for ideal solutions as well as the above-mentioned laws.[3] The total vapor pressure of such an ideal mixture is given by the expression

$$\sum_{i=1} p_i^o x_i \qquad (3)$$

where x_i is the mole fraction of component i and p_i^o is the vapor pressure of component i at the same temperature and ambient pressure (i.e., it is the vapor pressure of the neat solvent).

Petroleum thinners are mixtures of paraffinic and naphthenic hydrocarbons and smaller amounts of aromatic hydrocarbons. Some mixtures of these types of components form slightly non-ideal blends. An example is the binary mixture of ethylbenzene and 2,2,5-trimethyl-hexane presented in an article by Ellis[3]; it may be noted from this particular example that the deviation from the ideal was smaller at lower mole percents of aromatic in paraffin. Another example in the same article showed that a binary mixture of an aromatic and a naphthenic hydrocarbon exhibited deviation from ideal behavior comparable to that shown by the pair in the previous example.

Thus, we might expect to incur only minor errors if we assume that a mixture of petroleum distillates which consists predominantly of aliphatic components, like VM&P naphtha and mineral spirits, will exhibit ideal solution behavior.

*This is the LeChatelier Law concerning flammability, not the principle concerning the response of a system in equilibrium to an imposed stress.

DISCUSSION OF CALCULATION METHODS

The vapor pressure of a liquid increases as the temperature is elevated. This variation may be calculated by employing the Clausius-Claypeyron Equation from thermodynamics:

$$\frac{dp}{dT} = \bar{H}_v \, p / R \, T^2 \qquad (4)$$

where p is the equilibrium vapor pressure at temperature T, $\bar{H}_v(T)$ is the molar heat of vaporization at temperature T, R is the gas constant, and T the Kelvin temperature. This form of the equation depends on the assumption that the solvent vapor behaves like an ideal gas.

The solution of equation (4) requires a knowledge of how $\bar{H}_v(T)$ varies with T.

One approach is to employ an expression that gives $\bar{H}_v$ as a function of T. One such relation is the Watson correlation[4]:

$$\bar{H}_{v2} = \bar{H}_{v1} \, [\, 1 - (T_2/T_c) \,/\, 1 - (T_1/T_c) \,]^n \qquad (5)$$

where T_c = critical temperature °K and n = .19.

This relation is not applicable to petroleum fractions, since they do not have a critical temperature. A linear relation between $\bar{H}v$ and T is obtained if we assume

$$d(\bar{H}_v) / dT = \text{constant} \qquad (6)$$

This is not strictly true, but in a temperature interval significantly below the boiling point of a liquid, the curvature of the $\bar{H}_v$ – T curve is close to zero [see graph, pg 229, reference (5)]. This assumption of a linear relation between $\bar{H}_v$ and T was used to solve equation (4) in my method, denoted Method J.

Another approach is to assume that H_v is constant. This assumption was used in a method developed by Butler et al.[6] to predict the flash points of petroleum fractions boiling in the range 200 - 700°F. This is denoted Method B.

Two other methods examined do not involve the solution of equation (4). They are called index methods, since they involve the calculation of flash indexes of the components of a mixture and use of these indexes to compute the flash point of the mixture. These methods are denoted the WC and HB methods.

Method B

It is incorrect to assume that $H_v(T)$ is independent of T, since $H_v(T)$ decreases with increasing T and is zero at the critical point.[5] However, Butler et al.[6] employed this assumption in their method, as well as the further assumptions that mixtures of these fractions exhibit ideal solution behavior, that the $H_v(T)$ of all middle distillates was equal to 16,900 BTU/lb-mole, (the value of H_v for n-octane at its boiling point), and that the product of mole weight and vapor pressure at the flash point (in lb/in.^{2}) is 15.19 for all the distillates. These assumptions permit the derivation of a simple equation for the prediction of the flash point of a blend of middle distillates from a knowledge of the flash points of the component distillates:

$$\sum_{i=1} x_i \, e^{8500/T_i} = e^{8500/T_b} \qquad (7)$$

in which T_i = flash point of component fraction i in °Rankine, x_i = mole fraction i, T_b = flash point of the blend in °Rankine, and 8500 = H_v / R.

Butler et al. tested this equation by comparing calculated flash values to flash points determined by a Pensky-Martens closed cup tester for 39 different blends involving middle distillates from three different sources with flash points ranging from 90 to 200°F. They found the following ($\bar{x}$ = average difference between measured and calculated; and s = standard deviation of difference from $\bar{x}$): tests with heavy gas oil and heavy naphtha gave $\bar{x}$ = +1°F, s = 3°F; and tests with light gas oil and heavy naphtha gave $\bar{x}$ = −1°F, s = 1.5°F. They compared these results to a reproducibility of flash measurements of 2°F, obtained from a statistical analysis of experiments designed to obtain such a figure.

Method J

With the assumption of equation (6), the solution of equation (4) is:

$$\ln(p/p_b) = \frac{1}{R}[(\Delta \bar{c}_p)T_b - \bar{H}_v(T_b)] \times [(1/T) - (1/T_b)] + \frac{1}{R}[\Delta \bar{c}_p]\ln(T/T_b) \quad (8)$$

where p = vapor pressure at temperature T (°K), p_b = vapor pressure at the boiling point T_b (°K) = 760 mm Hg, $\bar{H}_v(T)$ = molar heat of vaporization at temperature T(°K), $\Delta \bar{c}_p = \bar{c}_p$ (vapor) − $\bar{c}_p$ (liquid), and $\bar{c}_p$ = molar heat capacity at constant pressure. At a given T(°K), the vapor pressure p_i^o of each component i in a blend is calculated by equation (8). Then the partial pressure exerted by component i is

$$p_i = p_i^o x_i \quad (9)$$

where x_i = mole fraction i. Then, we compute the vapor pressure p_i^F of each component i at its flash point from equation (8) and, along with equation (9), calculate the sum in equation (2). The temperature T^F at which this sum equals 1.000 ± .005 is designated the blend flash point.

WC Method

In the Wickey-Chittenden (WC) index method,[7] an index for each fraction in the blend is determined from its flash point by:

$$\log_{10} I = (-6.1188) + 4345.2/(T + 383) \quad (10)$$

where T = flash point °F. The flash index of the blend is computed from:

$$I_b = \sum_{i=1} V_i I_i \quad (11)$$

where V_i = volume fraction of fraction i, I_i = index of fraction i, and I_b = index of blend. The flash point of the blend is then computed by substituting I_b in equation (10). Equation (11) was determined empirically from observed flash points of 162 blends (12 ternary, the rest binary) involving 71 different stocks. The Tag and Pensky-Martens closed cup testers were used for stocks with flash points below 175°F; the Cleveland Open Cup tester was used for fractions having flash points in the interval 175 - 543°F. The authors state that the absolute deviation of experimental and calculated values for the 162 blends was 6°F, and that 71% of the deviations were within the reproducibility of measurement.

HB Method

In the Hu-Burns (HB) method,[8] the flash point of a blend is calculated from the flash points of the component fractions by:

$$\sum_{i=1} V_i T_i^n = T_b^n \quad (12)$$

where T_b = flash point of blend (°Rankine), T_i = flash point of component i (°Rankine), V_i = volume fraction of component i, and n = a constant. The value of n was determined so as to minimize error of prediction; it was found to lie in the interval −1/.04 to −1/.15, with the best value being −1/.06. Middle distillates from five different refineries were used, with flash points in the range 20 - 250°F. Blends made by mixing distillates from different refineries were not considered. A total of 97 blends were examined, with flash points in the range 86 - 194 °F (Pensky-Martens). When an n value of −1/.06 was used for all blends, only 47% of the flash points of the blends were predicted within 4°F of observed (repeatability of method—ASTM D93-66), while customizing the value of n for each refinery improved the percentage of differences (= predicted F.P. − observed F.P.) lying within the ASTM repeatability to 75%. These authors also stated that the Wickey-Chittenden method predicted well for only one of five refinery pools.

EXPERIMENTAL

Thirty separate hobby paint formulations were tested. All contain an alkyd resin, flatting agent, miscellaneous

Table 1—Values of Parameters Needed for Use of Flash Point Equations in Methods B, J, WC, and HB

	VM&P Naphtha	Mineral Spirits
Wt/gal @ 25°C[a]	6.20	6.50
Sp. Gr. @ 60°F[b]	0.750	0.779
API Gr.[c]	57.18	50.14
Av. boiling point (°F)[d]	265	340
M[e]	115	140
H_{vb} (BTU/lb)[f]	130	120
$\bar{H}_{vb}$ (cal/mole)[g]	8297.3	9324
p^F (mm Hg)	6.8[h]	5[i]
Δc_p[j]	−30.4	−31.8

(a) Value listed is approximate average of measured values of many lots of solvent received during several years from different suppliers.
(b) Reference (11).
(c) Calculated from API Gr. = [(141.5/Sp.Gr. @ 60/60 °F) − 131.5]. See reference (10).
(d) Calculated from (end point − initial boiling point)/2. Initial boiling point/end point values for VM&P naphtha and mineral spirits are 240/290 and 310/370, respectively; these are approximate average values derived from records of distillations on many lots received from different suppliers over several years.
(e) Average molecular weight. See text for derivation.
(f) Heat of vaporization at initial boiling point. See text for derivation.
(g) Calculated from $\bar{H}_{vb} = 0.555\ (M)(H_{vb})$. (1 BTU/1b = 0.555 cal/gram).
(h) Calculated from LEL given in MSDS of 0.9%. Then $p^F = 760\ (0.009) = 6.8$. v.p. @ 50°F not given on MSDS. See i.
(i) Is v.p. @ 100°F, given on MSDS.
(j) Calculated from equation (8). See example in text.

Table 2—Differences d = Calculated – Actual for 30 Paints

Product Number	Actual F.P. °F	VM&P Mole %	Min. Sp Mole %	d by Method B[a]	d by Method J[a,b]	d by Method WC[a]	d by Method HB[a,c]
1	52.8	85.25	14.75	0	+0.2	−0.7	+0.1
2	58.8	67.35	32.65	−0.7	−1.2	−2.2	−0.4
3	56.6	63.23	36.77	+2.9	+2.2	+1.1	+3.2
4	56.6	62.66	37.34	+3.1	+2.5	+1.3	+3.4
5	58.0	62.21	37.79	+1.9	+1.3	0	+2.2
6	59.6	60.14	39.86	+1.0	+0.4	−0.9	+1.3
7	61.8	58.14	41.86	−0.4	−1.1	−2.5	−0.2
8	59.0	57.67	42.33	+2.5	+2.2	+0.4	+2.8
9	60.0	56.70	43.30	+1.9	+1.4	−0.3	+2.2
10	59.5	56.18	43.82	+2.6	+1.9	+0.4	+2.9
11	62.7	55.86	44.14	−0.5	−1.2	−2.7	−0.2
12	62.0	51.22	48.78	+2.1	+1.3	−0.5	+2.3
13	64.5	47.98	52.02	+0.9	+0.1	−1.8	+1.2
14	64.6	44.72	55.28	+2.2	+1.4	−0.7	+2.5
15	64.5	43.73	56.27	+2.8	+2.0	−0.2	+3.0
16	64.7	43.19	56.81	+2.8	+2.0	−0.2	+3.0
17	77.8	22.23	77.77	+1.4	+0.7	−2.7	+1.3
18	89.8	5.76	94.24	+3.4	+3.2	+0.5	+3.2
19	59.0	80.54	19.46	−0.2	−0.5	−1.0	0
20	63.0	68.17	31.83	−0.5	−0.9	−1.9	−0.2
21	68.2	53.52	46.48	−0.6	−1.1	−2.7	−0.3
22	74.0	39.86	60.14	−0.6	−1.2	−3.5	−0.4
23	78.8	30.02	69.98	−0.5	−1.0	−3.7	−0.4
24	83.8	21.47	78.53	−0.4	−0.8	−3.9	−0.4
25	87.2	15.98	84.02	0	−0.3	−3.4	−0.1
26	89.9	11.50	88.50	+0.8	+0.6	−2.4	+0.6
27	93.9	8.09	91.91	−0.3	−0.4	−3.0	−0.4
28	95.8	4.65	95.35	+1.0	+1.0	−0.9	+0.9
29	98.5	2.33	97.67	+0.7	+0.7	−0.5	+0.6
30	99.5	1.16	98.84	+1.0	+1.0	+0.4	+1.0

For paints 1-18:	d	1.66	1.07	−0.65	1.88
	s_d	1.323	1.310	1.260	1.309
For paints 19-30:	d	0.03	−0.24	−2.21	0.08
	s_d	0.649	0.839	1.416	0.543
For paints 1-30:	d	1.01	0.55	−1.28	1.16
	s_d	1.358	1.305	1.515	1.387

(a) Flash points (°F) used in calculations: 49 for VM&P naphtha, 100 for mineral spirits in paints 1-18; 53.8 for VM&P naphtha, 101.8 for mineral spirits in paints 19-30.
(b) Parameters used in equation (8):

	$\bar{H}_{vb}$	$\Delta\bar{c}_p$	T_b
VM&P naphtha	8297	−30.4	388.6
Mineral Spirits	9324	−31.8	427.4

(c) n = −20 in equation (12).

additives, VM&P naphtha, and mineral spirits. Both the VM&P naphtha and the mineral spirits are ASTM Type IV petroleum distillates (see ASTM D 3735-78 and D 235-77, respectively).

Paints numbered 2-16 were made as a part of a separate project to formulate a new coating line. As a result, no attempt was made to maintain a constant weight of resin solids, total solids, and total solvent for all 15, nor did they all contain the same pigments.

Paints numbered 1, 17, and 18 were made during the same time period as paints 2-16. All three contained the same pigments, and approximately the same resin solids, total solids, and total solvent by weight. Paint 1 was made to have a much higher ratio of VM&P to mineral spirits than paints 2-16, so that its flash point would be lower; and paints 17 and 18 were made to have a lower ratio of VM&P naphtha/mineral spirits so as to produce higher flash points than paints 2-16. Paints 1-18 were made over the span of several months, and so contained different lots of materials, including the solvents.

Paints 19-30 all contain the same amounts by weight of resin solids, total solids, and total solvent, and the same pigments. The weight ratio of VM&P naphtha/mineral spirits was varied across the 12 paints so that the flash points would span the range of approximately 50°F (MSDS value of flash point for VM&P naphtha) to 100°F

(MSDS value of flash point for mineral spirits). The same lot of each component was used in each of paints 19-30.

The instrument used to measure the flash points of all the paints was a Setaflash 01SF. The method used was ASTM D 3278-78, Part B. All measured flash points were corrected to 760mm Hg pressure.

The flash points of the VM&P naphtha and mineral spirits used in paints 19-30 were measured to be 53.8°F and 101.8°F, respectively. The flash points of the VM&P naphtha and mineral spirits used in paints 1-18 were not determined.

DISCUSSION OF CALCULATION OF FLASH POINTS OF PAINTS

In all four methods of calculating the flash points of the paints, the VM&P naphtha and mineral spirits were assumed to be the only components. The effect of pigment and extender solids in depressing the vapor pressure of these solvents was ignored.

Calculation of flash points by all four methods requires knowledge of the flash point of each solvent. From previous measurements of the flash point of different lots of these solvents received from a number of suppliers, and correlation of their flash points with their initial boiling points, it is known that the flash point of VM&P naphtha is usually in the interval 49-52°F and that of the mineral spirits in the interval 100-102°F. For calculation of the flash points of paints 1-18, the flash points of VM&P naphtha and mineral spirits were assumed to be 49°F and 100°F, respectively, in all four methods, while for paints 19-30 the measured values of 53.8°F (corrected) for VM&P naphtha and 101.8°F (corrected) for mineral spirits were used.

The weights per gallon of VM&P naphtha and mineral spirits, which were used to compute their corresponding volume percents for calculating the flash points of the paints by equations (11) and (12), were 6.20 (typical) and 6.50 (typical), respectively.

The equations in Methods J and B need values of the molecular weight of VM&P naphtha and mineral spirits. These two petroleum fractions do not have a molecular weight, since each is a complex mixture of hydrocarbons of various molecular weights. But an average molecular weight was obtained for each solvent from a correlation of the API Gravity and average boiling point, with the average molecular weight and heat of vaporization at the boiling point H_{vb} (in BTU/lb) [found in a graph on p 3-222 in reference (9) (suitably enlarged)].

The average boiling point (end point—initial boiling point/2) was determined from our records to be approximately 265°F (typical boiling range 240-290°F) for VM&P naphtha and 340°F (typical boiling range 310-370°F) for mineral spirits.

The API Gravity ($= \dfrac{141.5}{\text{sp.gr. @ } 60/60°F} - 131.5$)[10] was determined from the specific gravities at 60°F.[11] The specific gravity of 0.750 for VM&P naphtha and 0.779 for mineral spirits translated into API values of 57.18 and 50.14, respectively.

Using the chart in reference (9), these values of API Gravity and average boiling point gave the following values of molecular weight M and H_{vb}:

	H_{vb} (BTU/lb)	M
VM&P naphtha	130	115
Mineral spirits	120	140

In addition to requiring values of the molecular weight of the VM&P naphtha and mineral spirits, use of the equations in Method J require values of $\bar{H}_{vb}$, $\Delta\bar{c}_p$, and p^F.

The value of $\bar{H}_{vb}$ for each was obtained from the equation:

$$\bar{H}_{vb} = 0.555\,(M)(H_{vb})$$

since 1 BTU/lb = 0.555 cal/g.[12]

The vapor pressure of mineral spirits at its flash point was found from an MSDS to be approximately 5mm Hg at 100°F; that of VM&P naphtha at its flash point was not given on any MSDS, but from an MSDS value for lower explosive limit of 0.9%, the pressure at the flash point was calculated to be 6.8mm Hg. (.009 × 760). The values of $\Delta\bar{c}_p$ for each solvent were calculated by inserting $\bar{H}_{vb}$, $p = p^F$, and T^F = flash point °K into equation (8), and solving for $\Delta\bar{c}_p$. For example, use of $p^F = 6.8$, $T^F = 388.6$°K (53.8°F), and $\bar{H}_{vb} = 8297.3$ gave $\Delta\bar{c}_p = -30.4$ (cal/mole°K) for VM&P naphtha.

All of the parameter values needed to calculate flash points by all four methods are listed in *Table* 1.

RESULTS AND DISCUSSION

The actual flash points are given in *Table* 2 for all 30 paints.

Also given in *Table* 2 are the differences of calculated and observed flash points (denoted d) for the 30 paints by each of the four methods. The average difference (denoted $\bar{d}$) and the standard deviation of the differences (denoted s_d) were computed for each method in three ways: for paints 1-18, for paints 19-30, and for all 30. The results of these computations are also displayed in *Table* 2.

Examination of *Table* 2 reveals the following observations:

(1) For all four methods, all 30 d's are less than 6.0, the value of repeatability of the measurement method.

(2) The value of s_d is smaller for paints 19-30 than for paints 1-18 for all the methods except for the WC Method. Since the flash points of the VM&P naphtha and mineral spirits in paints 19-30 was known, it would be expected that the variability of d would be less for paints 19-30 than for paints 1-18.

(3) The B, J, and HB Methods tend to underestimate flash point in the first part of the interval 50-100°F and overestimate it in the remainder, as shown by the results in *Table* 2 for paints 19-30.

(4) For the B, J, and HB Methods, $|d| \leqq 1.2$ for paints 19-30, and $|d| \leqq 3.1$ for Method B, 2.5 for Method J, and 3.4 for Method HB for all 30 paints. For Method WC, $|d| \leqq 2.5$ for paints 1-18, and $|d| \leqq 3.9$ for paints 19-30.

Thus, all four methods performed satisfactorily over the possible flash range of 50-100°F. Methods B, J, and

HB were comparable in accuracy and precision, while the WC Method was slightly inferior to the other methods as judged by these statistical criteria.

A number of points concerning the accuracy of the equations in Methods B and J should be borne in mind when using them to estimate flash points.

It has already been pointed out that the assumption of constant H_v in Method B is erroneous. Furthermore, if the values of H_{vb} derived for VM&P naphtha and mineral spirits in Method J are used to calculate H_v/R in Method B, values of 7523.7 and 8455, respectively, are obtained. The former figure is considerably different from the value of 8500 used in Method B. The success of Method B in estimating the flash points of the 30 paints considered here may be due to the fact that H_v increases as T decreases. In the temperature interval 50 - 100°F, it may be that the values of H_v/R at these temperatures are ranged about 8500 in such a way as to mutually compensate each other, one value of H_v/R above 8500 and the other below by an appropriate amount. The success of this method in predicting flash points of blends of petroleum fractions in the Butler et al. study suggests that, for the fractions considered, such a mutual compensation may have been operating.

In Method J, the value of p and T used to calculate $\Delta\bar{c}_p$ by equation (8) determines the shape of the p-T curve about this point. By comparing values of p calculated by this method with actual values for a number of hydrocarbons, it was found that the Method J underestimates p at temperatures below the T at which $\Delta\bar{c}_p$ was calculated, and conversely. This results in p_i/p_i^F underestimating actual at Ts below that used to compute $\Delta\bar{c}_p$, and conversely, and so the sum in equation (2) tends to be overestimated at temperatures closer to 50°F ($x_V >> x_M$), and conversely. The result is underestimation of flash points in mixtures in which VM&P naptha predominates, and conversely. The results for paints 19 - 30 in *Table* 2 for Method J are in accord with this prediction.

SUMMARY AND CONCLUSIONS

For paints containing an alkyd resin, pigments, extenders, miscellaneous additives, and the solvents VM&P naphtha and mineral spirits, the four methods considered have been shown to provide accurate estimates of their measured flash points. The calculations involved are relatively simple and are easily done on a programmable calculator. These calculations were performed on a Hewlett-Packard '97 calculator, and the programs were less than 220 steps in length. (This program is available upon request.)

These methods could obviate the time-consuming task of measuring the flash point of every formulation of this type a company produces by targeting for measurement only those products whose estimated flash points are within ± 5°F of one of the flammability limits.

These methods may also be applicable to other types of paints containing only petroleum fractions and/or aliphatic, naphthenic, and some aromatic hydrocarbons as thinners which have flash points greater than 100°F.

It was gratifying to find that Method J was as adequate a method of estimating the flash points of blends of petroleum fractions as are the other existing methods considered here because, unlike the latter methods, Method J can be easily modified to estimate the flash points of coatings containing mixtures of petroleum distillates and oxygenated solvents. This is the topic of a subsequent paper on flash point predictions.

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A Method for Estimating the Flash Points Of Coatings Containing Mixtures of Oxygenated and Hydrocarbon Solvents And Petroleum Distillates—Part II

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The flash point is an important property of a coating. Flash points are used by various regulatory agencies to classify coatings according to their relative flammability and to determine the container type and labeling, shipping, and storage requirements.

Flash points of solvent mixtures are sensitive to non-ideal behavior. Mixtures of oxygenated and hydrocarbon solvents often exhibit such non-ideal behavior. A method of calculating the flash points of coatings containing mixtures of oxygenated and hydrocarbon solvents and petroleum distillates is presented. The method accounts for mixture non-ideality by calculating component activity coefficients.

A comparison of the predicted flash points with actual flash points measured on a Setaflash 01SF for seven coatings and eight thinners showed that 14 of 15 estimated flash values differed from the measured flash point by less than the reproducibility of ASTM D 3278-78.

INTRODUCTION

Many thinners used in the coatings industry contain mixtures of oxygenated and hydrocarbon solvents and petroleum fractions, and some coatings contain such mixtures as the solvent part of the formulation. An accurate method of predicting the flash points of these types of coatings and thinners would expedite the formulation process by permitting the elimination of solvent combinations which would produce a flash temperature falling in the interval the formulator wishes to avoid. It would also eliminate the need to measure the flash temperature of every product that a company produces in order to assign them to the appropriate flammability class. Both of these consequences of an accurate flash point prediction method would contribute to the productivity of laboratory research and development efforts by eliminating the tedious and time consuming measurement of the flash points of every product made by a coatings company.

FLASH POINT CALCULATION METHOD

The calculation of component activity coefficients of mixtures of oxygenated and hydrocarbon solvents is necessary in the calculation of vapor-liquid equilibrium as they often exhibit strongly non-ideal solution behavior. Many expressions have been proposed to calculate the activity coefficients of such mixtures. Some examples, which are discussed in reference (1), are the equations of Margules, van Laar, and Wilson, the Non-Random Two Liquid (NRTL) method, and group contribution methods like Analytical Solution of Groups (ASOG), the Universal Quasi-Chemical (UNIQUAC) method, and its modification UNIFAC.

According to the authors of reference (1), the older methods of Margules and van Laar are simpler mathematically than the others, and give good results for many moderately non-ideal binary mixtures (as do the other methods). However, for strongly non-ideal mixtures, like solutions of alcohols and hydrocarbons, the Margules and van Laar equations are not as accurate as the other meth-

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Table 1—Composition and Flash Point Interval of Eight Thinners and Seven Coatings

Thinner	Flash Interval	Component Solvents	Solvent Mole Fractions
1.	33-34°F	Ethyl acetate	0.3586
		Methyl ethyl ketone (i.e., MEK)	0.4381
		PM acetate[a]	0.2033
2.	34-36°F	Ethanol	0.3156
		Isopropanol	0.2057
		Isobutanol	0.0687
		Isopropyl acetate (i.e., IPAc)	0.1139
		n-Butyl acetate	0.1752
		MEK	0.1210
3.	39-40°F	Ethanol	0.1949
		Ethyl acetate	0.2203
		n-Butyl acetate	0.0693
		Methyl isobutyl-ketone (i.e., MIBK)	0.4301
		PM acetate	0.0855
4.	51-52°F	Ethanol	0.1482
		Isobutanol	0.4605
		n-Amyl alcohol	0.2926
		Toluene	0.0988
5.	57-60°F	Isopropanol	0.5322
		Isobutanol	0.3477
		n-Butyl acetate	0.1201
6.	70°F	Propasol P[b]	0.2302
		GL 150[c]	0.0085
		VM&P naphtha[d]	0.3101
		Mineral spirits/66[e]	0.4149
		SS 140[f]	0.0363
7.	69°F	Diacetone alcohol (i.e., DAA)	0.3239
		Xylene	0.0836
		MIBK	0.5018
		PM acetate	0.0906
8.	109-110°F	Propasol P	0.9166
		Xylene	0.0644
		GL 150	0.0189

Coating	Flash Interval	Component Solvents	Solvent Mole Fractions
9.	27-31°F	Isopropanol	0.3264
		Isobutanol	0.3177
		Toluene	0.1491
		n-Butyl acetate	0.0733
		Acetone	0.1335
10.	35-37°F	DAA	0.2360
		Toluene	0.1146
		Mineral spirits	0.0008
		MEK	0.3802
		MIBK	0.2684
11.	38-40°F	DAA	0.2485
		Toluene	0.1156
		Mineral spirits	0.0639
		MEK	0.2899
		MIBK	0.2821
12.	38-40°F	DAA	0.2637
		Toluene	0.1281
		MEK	0.3083
		MIBK	0.2999
13.	45-46°F	Ethanol	0.3783
		Isobutanol	0.3255
		n-Amyl alcohol	0.0884
		Toluene	0.1901
		Acetone	0.0177
14.	47-49°F	DAA	0.2249
		Toluene	0.1092
		Mineral spirits	0.0334
		MEK	0.2629
		MIBK	0.2557
		PM acetate	0.1139
15.	57-58°F	Toluene	0.2428
		n-Amyl acetate	0.2001
		MIBK	0.5571

(a) Propylene glycol monomethyl ether acetate.
(b) n-Propoxy propanol.
(c) Aromatic petroleum solvent naphtha—150°F flash point.
(d) Light aliphatic petroleum solvent naphtha—50°F flash point.
(e) Medium aliphatic petroleum solvent naphtha—100°F flash point.
(f) Medium aliphatic petroleum solvent naphtha—140°F flash point.

ods. For these latter mixtures, they indicate that the Wilson equation is more useful than the other newer methods since it is mathematically simpler than UNIQUAC and contains only two adjustable parameters (vs three for NRTL).

The method of calculating the activity coefficients of multicomponent mixtures containing both oxygenated and hydrocarbon solvents used here was adapted from a paper on the prediction of flash points of such mixtures by Walsham.[2]

Walsham used a multicomponent extension of the van Laar equation developed by Black to calculate component activity coefficients. (See *Appendix* for explanation of method.)

Walsham's method of calculating the flash points of mixtures of oxygenated and hydrocarbon solvents was also used here. He modified the LaChatelier sum:

$$\sum_{i=1} p_i \gamma_i x_i / p_i^F \qquad (1)$$

where p_i = vapor pressure of pure i at test T(°K) in mm Hg, γ_i = activity coefficient of component i at test T(°K), x_i = mole fraction i, and p_i^F = vapor pressure of i at its TOC flash point. Walsham found that this equation was not significantly more accurate than simply using the flash point of the lowest flashing component as the mixture flash point. He performed a regression analysis on the relation between heat of combustion and molecular weight for 25 solvents, both hydrocarbon and oxygenat-

ed, and found that the heat of combustion is proportional to the molecular weight raised to the power 1.25. On this basis, Walsham defined a flashing index for component i in a mixture to be:

$$I_i = 1 / p_i^F M_i^{1.25} \quad (2)$$

where M_i is the molecular weight of component i. Then, for a mixture of n components, he defined the sum:

$$\sum_{i=1}^{n} I_i p_i \gamma_i x_i M_v^{1.25} \quad (3)$$

where M_v = mean vapor molecular weight at test temperature T (°K). The temperature T (°F) at which this sum is equal to 1.0 Walsham designated the mixture flash point. He compared flash points calculated in this way with measured TOC flash points of 40 solvent mixtures, and found 95% confidence limits for differences between actual and calculated of +8.0°F to +3.0°F (mean d = 5.18, std. dev. of d = 8.06).

Walsham did not consider mixtures with dispersed or dissolved solids, as is done in this paper.

In this study, it was the prediction of Setaflash closed cup (SFCC) flash points of oxygenated-hydrocarbon mixtures which was of primary interest. The only modification of Walsham's method required in this study is the substitution in equations (1) or (3) of the vapor pressure at the SFCC flash point instead of that at the TOC flash point.

The use of equations (1) and (3) require calculation of the vapor pressure of each component of a mixture at each test T(°K). There are many methods available in the literature for vapor pressure estimation. A few of the more accurate and general methods are given in reference (1) (Chapter 7). The authors of this reference examine the Antoine equation, the Gomez-Thodos equation, the two reference fluid or Lee-Kesler method, and the Wagner equation, as well as other equations.

They state that the Wagner equation has been found to be particularly successful in predicting vapor pressures over wide temperature intervals and that it reproduces the correct shape of the vapor pressure curve from a reduced temperature (T/T_c; T_c = Kelvin critical temperature) of 0.5 up to T_c. They compare the Wagner equation to the Antoine equation and assert that the latter does not extrapolate well to values outside the temperature interval used to calculate the constants used in it. They also maintain that the Wagner equation does not extrapolate well to reduced temperatures below 0.5, which is precisely the region of interest when calculating flash points.

The constants for the Antoine equation, for the Frost-Kalkwarf-Thodos equation, and for the modified Miller equation [which, according to the authors of reference (1), gives a better fit to the experimental data than the Antoine equation] are available in reference (1) for only some of the solvents considered here, and in some of these cases the temperatures at which the equations may be used with accuracy did not extend to low enough temperatures.

Another method of estimating vapor pressures is to use the Clausius-Claypeyron equation from thermodynamics and solve it after substituting a suitable expression for the molar heat of vaporization $\bar{H}_v(T)$ as a function of T. This approach was found in reference (3) (Chapter 14). The $\bar{H}_v$-T relation used there is the Watson correlation:

$$\bar{H}_v(T) = \bar{H}_v(T_b) (1 - T_r)^m / (1 - T_{rb})^m \quad (4)$$

where m = a constant, $T_r = T/T_c$, $T_{rb} = T_b/T_c$, and T_b = boiling point °K. This equation is substituted into the Clausius-Claypeyron equation:

$$\frac{d(\ln p)}{dT} = \bar{H}_v(T) / Z R T^2 \quad (5)$$

where R = gas constant 1.987, and Z = difference of compressibilities of liquid and vapor. The solution of equation (5) is then:

$$\ln p = [\bar{H}_v(T_b)/Z_b R T_b(1 - \tfrac{1}{\alpha})^m] \times$$

$$[(1 - \tfrac{1}{\alpha})^m - (1 - \tfrac{T'_{rb}}{\alpha})^m - \tfrac{m}{\alpha}(1 - \tfrac{T'_{rb}}{\alpha})^{m-1} \ln T'_{rb}] \quad (6)$$

where $\alpha = T_c/T_b$ and $T'_{rb} = T/T_b$. Sufficient accuracy, according to the author in reference (3), is usually obtained by setting $Z_b = .97$ and m = 0.19 for all liquids.

The parameters in equation (6) were obtained for many of the solvents considered here in references (1) (*Appendix*), (4), and (8). For those solvents for which experimental values of these parameters were not given in the previously mentioned sources, estimated values were calculated and used. T_c was estimated by Lydersen's increments[5] and $\bar{H}_v(T_b)$ was estimated by the Reidel equation.[6,7]

Equation (6), with m = .19, was tested by comparing the calculated vapor pressures at selected temperatures, with actual vapor pressures at the same temperatures found in Tables 3-8 of reference (8) for eight of the solvents in the mixtures considered. It was found that the vapor pressures were underestimated by amounts of 13-60% for methyl ethyl ketone, ethyl acetate, ethanol, isopropyl alcohol, and isobutyl alcohol; and they were overestimated by up to 60% for n-amyl alcohol; by up to 250% for methyl isobutyl ketone; and were within ± 5% for acetone, isopropyl acetate, and toluene. Although the errors of 60% and 250% would seem to be unacceptably large, it should be kept in mind that p_i^F in equation (1) is also estimated by equation (6); as a result, p_i/p_i^F in equation (1) or (3) will not differ from the actual quantity by a comparable amount. In fact, since the percent error diminishes in absolute value as temperature increases from the lowest values considered in each case, then at temperatures below the flash point the calculated value of p_i/p_i^F is less than actual, while at temperatures above the flash point the calculated value is greater than actual. In each case the percent error of calculated p_i/p_i^F from actual is less (at most temperatures considered) than the amount by which calculated p_i differs from actual p_i. Thus, in a multicomponent mixture containing components with significantly different flash points, a component for which p_i/p_i^F is less than actual will tend to be compensated by one for which this calculated ratio is greater than actual, thus diminishing the expected error of calculated flash point from actual.

Equation (6) is not applicable to petroleum fractions because they do not have a critical temperature. The

Table 2—Matrix of S_i and B_{ij} Values for Use in Multicomponent van Laar Equation to Calculate Activity Coefficients of Non-Ideal Mixtures

	Alcohols[a]	Ether-Alcohols[b]	Aromatic Hydrocarbons[c]	Aliphatic Hydrocarbons[d]	Esters[e]	Ketones[f]	Chlorinated Aliphatic Hydrocarbons[g]	Glycol Ether Esters[h]	Water
S_i	1.0	1.0401	0.6332	0.5441	1.0319	0.9225	1.9605	1.6249	0.3449
				B_{ij} (i = row, j = column)					
1	0	0	2.5416	3.5234	1.0647	0.9933	1.3083	0.6963	3.8712
2	0	0	2.6038	3.8872	0.9899	0.7581	1.2579	0.6664	3.2037
3	2.5416	2.6038	0	0.4143	0	0.2879	1.0947	0.4143	17.8879
4	3.5234	3.8871	0.4143	0	1.7561	1.8923	3.6785	2.5479	23.1787
5	1.0647	0.9899	0	1.7561	0	0	0.4555	0.0924	6.8709
6	0.9933	0.7581	0.2879	1.8923	0	0	−0.3866	0.2844	5.6292
7	1.3083	1.2579	1.0947	3.6785	0.4555	−0.3866	0	0.2068	3.1889
8	0.6963	0.6664	0.4143	2.5479	0.0924	0.2844	0.2068	0	5.8579
9	3.8712	3.2037	17.8879	23.1787	6.8709	5.6292	3.1889	5.8579	0

(a) n-Butyl alcohol.
(b) Ethylene glycol monoethyl ether.
(c) Cumene.
(d) Nonane.
(e) n-Butyl acetate.
(f) Methyl isobutyl ketone.
(g) Dichloroethane.
(h) Ethylene glycol monomethyl ether acetate.

Table 3—Values of d = Calculated − Actual Flash Point, and of $\bar{d}$, s_d, and % Less Than Reproducibility of Measurement Method for the Eight Thinners and Seven Coatings

	Using Unadjusted B_{ij}				Using Adjusted B_{15}, B_{23}, B_{24}[a]			
	Largest d		Smallest d		Largest d		Smallest d	
Thinner	(1)	(3)	(1)	(3)	(1)	(3)	(1)	(3)
1	−4.1	−4.2	−3.1	−3.2	−6.7	−6.6	−5.7	−5.6
2	+6.5	+5.8	+4.5	+3.5	+3.8	+2.6	+1.8	+0.6
3	+7.4	+7.3	+6.4	+6.3	+2.2	+2.8	+1.2	+1.8
4	+4.9	+6.0	+3.9	+5.0	+4.9	+6.0	+3.9	+5.0
5	+3.0	+1.8	0.0	−1.2	−3.0	−4.8	0.0	−1.8
6	−4.7	−4.7	−4.7	−4.7	−1.4	−1.5	−1.4	−1.5
7	+3.7	+3.8	+3.7	+3.8	+3.7	+3.8	+3.7	+3.8
8	−8.7	−7.9	−7.7	−6.9	−0.8	+1.1	+0.2	+0.1
$\bar{d}$	+1.00	+0.99	+0.38	+0.36	+0.34	+0.43	+0.46	+0.30
s_d	5.98	5.79	5.07	4.98	4.01	4.37	3.08	3.36
%<repr.	62.5	75.0	75.0	75.0	87.5	87.5	100	100
Coating								
9	−3.5	−3.2	+0.5	+0.8	−3.4	−3.1	+0.6	+0.9
10	+2.9	+3.8	+0.9	+1.8	+2.9	+3.8	+0.9	+1.8
11	+4.0	+4.9	+2.0	+2.9	+4.0	+4.9	+2.0	+2.9
12	+2.3	+2.6	+0.3	+0.6	+2.3	+2.6	+0.3	+0.6
13	−7.0	−5.7	−6.0	−4.7	−6.5	−4.9	−5.5	−3.9
14	−4.4	−4.1	−2.4	−2.1	−4.4	−4.1	−2.4	−2.1
15	−1.5	−1.8	−0.5	−0.8	−1.5	−1.8	−0.5	−0.8
$\bar{d}$	−1.03	−0.50	−0.75	−0.21	−0.94	−0.37	−0.66	−0.09
s_d	4.19	4.21	2.69	2.57	4.06	4.04	2.53	2.35
%<repr.	100	100	100	100	100	100	100	100

(a) B_{15} = 1.7918, B_{23} = 1.5474, and B_{24} = 2.8309.
(1) Using equation (1) for flash point calculation.
(3) Using equation (3) for flash point calculation.

method used here to calculate vapor pressures for these solvents at various test temperatures was presented by the author in a previous paper.[9]

EXPERIMENTAL

The flash points of eight thinner mixtures and seven coatings were measured on a Setaflash 01SF instrument.

All 15 products were production formulations made for use by hobby model builders. The composition of the thinners, and of the thinner component of the coatings, is given in *Table* 1.

The flash point measurement method followed is ASTM D 3278-78, Part B. All measured flash points were corrected to 760mm Hg air pressure. The flash points were not all measured to within 1°F; in some cases, they were measured to within 4°F, since this was adequate at the time to assign the products to a definite flammability class. These flash intervals are also given in *Table* 1.

RESULTS AND DISCUSSION

Flash points for each of the 15 compositions were calculated by both equations (1) and (3), using both the B_{ij} values given in *Table* 2 and using adjusted values B_{15}, B_{23}, and B_{24} for activity coefficient calculation (the latter were used to obtain closer agreement of calculated and actual values).

The differences [d = (calculated flash point − actual flash point)] for all 15 products were calculated in two ways: the largest d and the smallest d. The largest d for each product was computed using that member of the pair of calculated values and that flash point from the measured flash interval which yield the largest difference. The smallest d was calculated in a similar fashion. These differences are tabulated in *Table* 3. Also given in *Table* 3 are the averages $\bar{d}$, the standard deviation of the differences s_d, and the percentage of observations which are less than the reproducibility of the measurement method.

Examination of *Table* 3 yields the following observations:

(1) Substituting the values of activity coefficients calculated using the adjusted B_{ij} for those calculated from data in Walsham's article increases the number of thinners having largest d [by equation (1)] < reproducibility of method from 5 of 8 to 7 of 8. Similarly, the number with largest d [by equation (3)] < reproducibility increases from 6 of 8 to 7 of 8; the number with smallest d [by both equations (1) and (3)] < reproducibility increases from 6 of 8 to 8 of 8. This substitution also reduces the value of s_d for all four calculations and reduces the value of d for the largest d [by both equations (1) and (3)].

(2) This substitution does not increase the number of coatings having d < reproducibility of method; all seven coatings have smallest and largest d < 9 for both equations. The substitution does diminish s_d for largest d (both equations) slightly, but it increases s_d for smallest d (both equations) slightly.

(3) Equation (3) is only slightly more accurate than the LeChatelier equation, using the value of $\bar{d}$ in *Table* 3 as a measure, whereas these equations are comparable in precision, as judged by the values of s_d.

SUMMARY AND CONCLUSIONS

It would appear that the multicomponent van Laar activity coefficients for non-ideal solvent mixtures provide values of this parameter which permit reasonably accurate estimates of SFCC flash points when used in the LeChatelier equation or in Walsham's modification of it. Appropriate adjustment of the parameters in equation (7) may also provide closer agreement between calculated and actual flash values of some of the solvent mixtures a company produces. By targeting for actual measurement only those thinners or coatings which have a calculated flash point within 10°F of one of the relevant flammability limits, a significant savings of labor and time could be realized.

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(7) Reference (1), p 226.

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APPENDIX

Activity coefficients of components of each mixture were calculated by the method used by Walsham, which he derived from a procedure presented in a paper by Black.[10] Walsham uses a multicomponent van Laar type equation which employs binary infinite dilution activity coefficients.

The equation employed by Walsham for the activity of component i in a mixture of m components is:

$$\frac{\ln \gamma_i}{S_i} = \sum_{j=1} \phi_j B_{ij} - \sum_{j=1} \sum_{k>j} \phi_j \phi_k B_{jk} \qquad (7)$$

The parameters ø and B_{ij} in this equation are determined by the following equations:

$$\phi_i = x_i S_i \Big/ \sum_{j=1} x_j S_j \qquad (8)$$

$$B_{ij} = \ln \gamma_{ij}^{\infty} / S_i = \ln \gamma_{ji}^{\infty} / S_j \quad (9)$$

The B_{ij} are binary molecular interaction coefficients, while S_i is the weighting factor of i, x_i is the mole fraction of i, and γ_{ij}^{∞} is the activity coefficient at infinite dilution of component i in j. The γ_{ij}^{∞} are taken from Table 4 in Walsham's paper; these values were generated by applying the Analytical Solution of Groups procedure to a selected solvent pair from each of nine groups of solvents classified by functional groups.[11] Since $\gamma_{ii}^{\infty} = 1$, $B_{ii} = 0$. Also, $B_{ij} = B_{ji}$.

By setting $S_1 = 1$, where 1 = alcohols, Walsham derives all eight B_{1j} from equation (9) and the γ_{ij}^{∞} from his Table 4. The remaining eight S_j are computed, and the remaining B_{ij} are computed by using the same equation and Walsham's Table 4. This procedure leads to inconsistencies in calculated values of the B_{ij}; that is, $B_{ij} \neq B_{ji}$ for $i < j$. This may be due to the fact that equation (7) is only part of the full equation presented in Black's paper. Walsham ignores Black's modification of equation (7) which includes empirical terms c_{ij}, which are estimated from binary vapor-liquid equilibrium data and then used with the γ_{ij}^{∞} and γ_{ji}^{∞} to calculate the γ_i by the full equation. In this work, the B_{ij} with $i < j$ were employed, and the B_{ji} were ignored; this resulted in the symmetric matrix of B_{ij} given in *Table* 2.

Walsham, in a paper with Edwards, employed this multicomponent van Laar expression for activity coefficients to calculate evaporation times and solvent balances for non-ideal solvent mixtures.[11] They obtained good agreement of observed and predicted percent weight evaporated with time for nine different solvent blends, which suggests that this method of activity coefficient calculation would yield reasonably accurate results in other vapor-liquid equilibria like flash point prediction [Walsham applied the method to flash point prediction in a later paper, as indicated in the text—reference (2)].

Another indication of the adequacy of this method of activity coefficient calculation is obtained by comparing the results of Walsham and Edwards to those presented in a paper by Rocklin and Bonner.[12] The latter authors used the much more elaborate UNIFAC method to calculate activity coefficients for multicomponent water/solvent blends in order to predict evaporation time and solvent balance; they applied their method to two of the solvent blends considered by Walsham and Edwards (non-aqueous), and obtained results of comparable accuracy.

Estimation and Prediction Of Degradation of Coating Films by Frequency at Maximum Phase Angle

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In real coating systems, the degradation of pigmented coating films was evaluated by the frequency at maximum phase angle ($f_{\theta max}$) obtained from electrochemical impedance measurement. The $f_{\theta max}$ and film resistance (R_f) by electrochemical impedance measurement showed a linear relationship on a log-log plot. The degradation of coating films could be predicted by the determination of $f_{\theta max}$ values. When the calculated values of $f_{\theta max}$ and R_f were corrected by phenomenological coefficient (β) in the range of 0 to 1, its linear relation was nearly consistent with that obtained in the measured values.

INTRODUCTION

The degradation of coating films and underfilm corrosion have been widely investigated by electrochemical impedance measurements.[1-10] Recently, the authors have reported a novel method utilizing the frequency at maximum phase angle ($f_{\theta max}$) obtained from an electrochemical impedance measurement to evaluate the degradation of boiled linseed oil (LO) coatings on steel.[11] The degradation of coating film was obvious and rapidly evaluated from $f_{\theta max}$ by the comparison with R_f. The relationship between $f_{\theta max}$ and R_f was confirmed by theoretical calculation by the following equation,

$$\log(f_{\theta max}) = -\log(2\pi) - 0.5\log(R_s C_f^2) - 0.5\log(R_f) \quad (1)$$

where R_s and C_f are solution resistance and film capacitance, respectively.[11] In this paper, in order to develop a method for the prediction of lifetime of coating film in real systems, the degradation of pigmented coating films was evaluated and was predicted by $f_{\theta max}$. After correcting the calculated values by phenomenological coefficient (β), the linear relation between $f_{\theta max}$ and R_f obtained by calculation was found to agree with that obtained in the measured values.

EXPERIMENTAL

Materials

Binders used were LO (Wako Pure Chemical Industries, reagent grade), polyurethane resin (UR) (Dainippon Toryo), and long oil alkyd resin (LA) (Kansai Paint). Lead naphthenate was added to LO (weight ratio; LO:lead naphthenate = 95:5) and heated to 140-150°C for 4 hr in exposure to air. The LA was used commercially without purification.

Pigments used were bi-metal oxides (i.e., ferrite derivatives) mixed with various metal oxides and ferrite ($MO{\cdot}Fe_2O_3$, M = Ca, Ba, and Zn), which were purchased from Tohoku Metal Industrials Ltd. and Dowa Mining Ltd. (reagent grade) and red lead oxide (Pb_3O_4, reagent grade, Kanto Chemical Co., Inc.). The mean particle size of various ferrites was about 1 μm. The molar ratio (MO/Fe_2O_3) of bi-metal oxides (ferrite derivatives) was 7/3, 5/5, and 3/7, and the bi-metal oxide of MO/Fe_2O_3 = m/n (Mm) (for example, the abbreviation of $ZnO{\cdot}Fe_2O_3$ of ZnO/Fe_2O_3 = 3/7 is "Zn3").

Cold-rolled steel plate (JIS G3141, SPCC-SB, 7.0 × 15 × 0.08 cm) was purchased from Nippon Test Panel Co., Ltd. for use as a substrate for coating. Water was triple distilled and other chemicals used were reagent grades.

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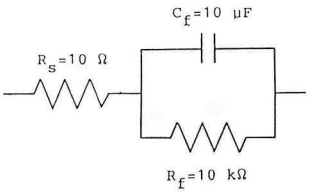

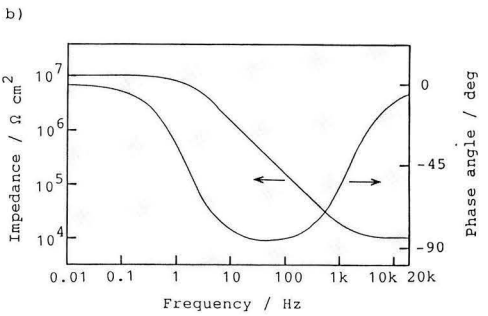

Figure 1—Equivalent circuit used to represent the coating film (a) and its Bode plot (b). R_s, C_f, and R_f are solution resistance, film capacitance, and film resistance

Preparation of Paints

The pigmented paints were prepared by mixing binders with pigments under the condition of constant concentration of pigment. The concentration of pigment defined as oil volume absorbed pigment volume = critical pigment volume concentration (CPVC) and concentration (PVC)/CPVC = constant. The ratios of PVC/CPVC were 1/3 for LO and 1/10 for UR and LA.

Specimen and Solution

Cold-rolled steel plate was polished with emery paper up to No. 1200 after soldering of the connecting wire and cleaned successively by immersion in perchloroethylene and ethanol. The pigmented paints were coated on this steel plate by an applicator or barcoater and dried for a week. The thickness of pigmented paint film was ca. 40 μm. The back and edges of the specimen were thickly masked by paraffin wax so that a surface area of 9.0 cm^2 was exposed.

The solution for immersion was a 3% NaCl aqueous solution used at 30°C.

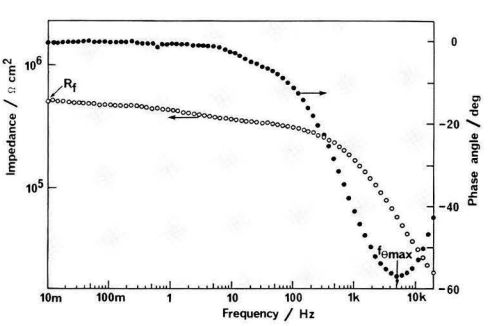

Figure 2—Bode plot of pigmented coating film of LO/Ca5 after immersion for 7 d

Electrochemical Measurements

Electrochemical impedance measurements were carried out by using a frequency response analyzer (FRA) (NF Electronic Instruments, 5020), and a potentiostat (Toho Technical Research, 2000). They were conducted using a standard three-electrode configuration at the immersion potential. The applied signal amplitude was 9-30 mV (RMS) in the frequency range from 20 kHz to 10 mHz. The $f_{\theta max}$ and R_f for coating films were obtained using the spectra of electrochemical impedance measurements.

RESULTS AND DISCUSSION

The equivalent circuit used to represent the coating film and its Bode plot is shown in *Figure* 1. The values of $f_{\theta max}$ and R_f of coating films were determined by the equivalent circuit and its plot. The $f_{\theta max}$ could be rapidly and easily measured in comparison with R_f because $f_{\theta max}$ appears in the range of high frequency. For example, the Bode plot of pigmented coating film of LO/Ca5 after immersion for 7 days is shown in *Figure* 2. The $f_{\theta max}$ and R_f were determined by analysis of the Bode plot and equivalent circuit.

The relation between $f_{\theta max}$ and R_f for various pigmented coating films is shown in *Figure* 3. The R_f increased with the decrease of $f_{\theta max}$ value in each coating film system. The $f_{\theta max}$-R_f relation in each coating film system indicated linear one, and the result corresponded to that of nonpigmented coating film reported previously.[11] It is thought that the relation between $f_{\theta max}$ and R_f is applica-

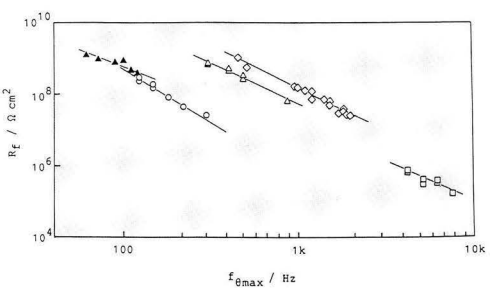

Figure 3—Relationship between frequency at maximum phase angle ($f_{\theta max}$) and film resistance (R_f) of various pigmented coating films. O—LA/Ba3 (LA; long oil alkyd resin, Ba3; BaO/Fe_2O_3 (molar ratio) = 3/7); Δ—LA/Zn5 (Zn5; ZnO/Fe_2O_3 = 5/5); ▲—LA/Zn5 (measurement using other apparatus and other conditions); ◇—LO/Pb_3O_4 (LO; boiled linseed oil); and □—LO/Ca5 (Ca5; CaO/Fe_2O_3 = 5/5)

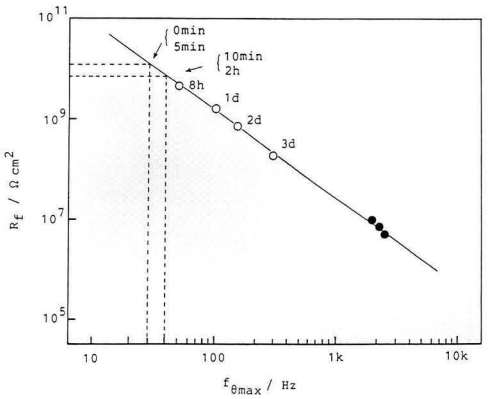

Figure 4—Relationship between $f_{\theta max}$ and R_f on pigmented polyurethane resin (UR/Zn5) coating film. UR/Zn5—polyurethane resin coating film containing ZnO/Fe_2O_3 (= 5/5, molar ratio). Open circle plots are data after immersion for 8 h, 1 d, 2 d, and 3 d, and closed circle plots are data after immersion for 5 d to 7 d. Dotted line shows the relation between $f_{\theta max}$ and R_f and in early immersion time

ble to any coating films (1) with and without pigments, (2) of any binders (i.e., LO and LA), and (3) of any pigments, ferrite derivatives, and Pb_3O_4. From the $f_{\theta max}$-R_f relation, the R_f is determined only by measuring of $f_{\theta max}$ which easily obtains one in comparison with R_f.

For the application of the $f_{\theta max}$-R_f relation in coating films, the prediction of degradation for coating film was investigated. The $f_{\theta max}$-R_f relation of UR/Zn5 coating film is shown in *Figure* 4. Four open circle plots represent data after immersion for eight hours, one day, two days and three days and enable a straight line to be drawn. Furthermore, three closed circle plots after immersion for five days to seven days were on the extrapolation of straight line determined by four opened circle plots. Therefore, it seems that $f_{\theta max}$ related to R_f in immersion time under this experimental condition. The relation of R_f with immersion time is not only obtained, but also that of $f_{\theta max}$ with immersion time. With the measurement of $f_{\theta max}$, the R_f is not only provided, but also immersion time is obtained. It is suggested that the degradation and lifetime of coating films can be evaluated by determining $f_{\theta max}$ instead of R_f.

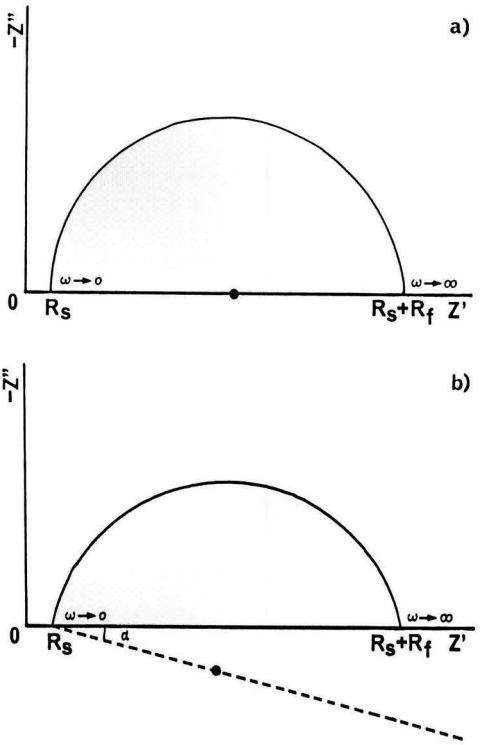

Figure 5—Complex plane plots of normal semicircle (a) and distorted semicircle produced by dispersion of time constant (b). Dotted line and closed plot is the diameter of distorted semicircle and its center, respectively. Z' and Z" are real and imaginary components of impedance, respectively. ω is frequency in radians per second. α is angle between Z' axis and diameter of distorted semicircle, α = (π/2)·(1-β)

The R_f of coating films cannot be measured after a short immersion time because the coating films have a high resistance or are sound, radio ham noise occurs, and the spectra of electrochemical impedance measurements are disordered below ca. 500 Hz. But, by the relation between $f_{\theta max}$ and R_f, the R_f in early immersion time can

Table 1—Values of Various Parameters Containing Corrected Ones

Immersion time	R_s/Ω cm^2	R_f/Ω cm^2	β	C_f/F cm^{-2}	$f_{\theta max}$/kHz
30 min	2.7×10^4	3.18×10^6	0.955	2.06×10^{-10}	2.64
40 min	2.7×10^4	2.88×10^6	0.944	2.19×10^{-10}	2.58
50 min	2.7×10^4	2.32×10^6	0.944	2.22×10^{-10}	2.90
60 min	2.7×10^4	1.84×10^6	0.950	2.13×10^{-10}	3.48
100 min	2.7×10^4	1.68×10^6	0.944	2.23×10^{-10}	3.40
210 min	2.7×10^4	1.61×10^6	0.944	2.31×10^{-10}	3.33
15 h	2.7×10^4	2.71×10^6	0.944	2.27×10^{-10}	2.64
2 d	2.4×10^4	6.56×10^5	0.922	2.60×10^{-10}	5.15
4 d	2.3×10^4	3.83×10^5	0.911	2.82×10^{-10}	6.19
5 d	2.1×10^4	2.01×10^5	0.900	3.32×10^{-10}	7.80
6 d	1.9×10^4	1.44×10^5	0.889	3.70×10^{-10}	8.75
7 d	1.8×10^4	1.18×10^5	0.872	3.90×10^{-10}	9.59

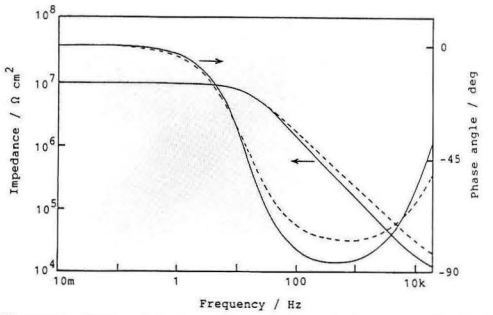

Figure 6—Bode plots in various values of phenomenological coefficients (β). —β = 1 and - - - —β = 0.9. $R_s = 1 \times 10^4$ Ω·cm², $R_f = 1 \times 10^7$ Ω·cm², and $C_f = 1 \times 10^{-9}$ F·cm⁻²

also be determined, as shown in *Figure* 4. In any case, the degradation of coating films can be evaluated and predicted in various test periods by the measurement of $f_{\theta max}$. The measurement of $f_{\theta max}$ also contributes to the shortening of measuring time, and is effective as a corrosion monitor.

In electrochemical impedance measurement, an alternative method of plotting the circuit in *Figure* 1 is by means of complex plane plot (Nyquist plot), which is a plot of real impedance (Z′) vs negative of imaginary impedance ($-Z''$), as shown in *Figure* 5a. In the real systems of coating films degradation, the semicircle often exhibits some depression below the axis of Z′, that is, the center of the semicircle is shifted from Z′ axis to the lower part of Z′ axis, as shown in *Figure* 5b. Apparently, the semicircle is distorted. The cause of this behavior is believed to be a dispersion (or re-partition) of time constants around a central value.[12] The response in *Figure* 5b is modeled by[13]:

$$Z = R_s + R_f/[1 + (j\omega\tau)^{\beta}] \quad (2)$$

where β is phenomenological coefficient, j is square root of negative one, ω is frequency, and τ is product of R_f and C_f (time constant). The β is given by:

$$\beta = 1 - (2\alpha/\pi) \quad (3)$$

where α is angle between Z′ axis and diameter of distorted semicircle. The β is in the range of 0 to 1. In real systems, β must be used to correct the linear relationship between $f_{\theta max}$ and R_f obtained by calculation. The β seems to be the parameter of $f_{\theta max}$ because the θ_{max} and $f_{\theta max}$ is changed by β. For example, *Figure* 6 shows the Bode plots under the conditions of $R_s = 1 \times 10^4$ Ω·cm², $R_f = 1 \times 10^7$ Ω·cm², and $C_f = 1 \times 10^{-9}$ F·cm⁻². According to β values, the Bode plot, i.e., θ_{max} and $f_{\theta max}$, was changed; the values of θ_{max} were ca. 500 Hz at β = 1 and 750 Hz at β = 0.9.

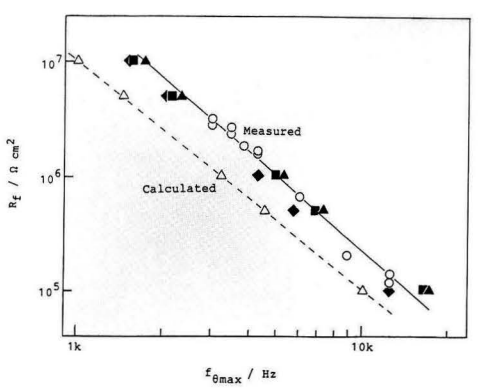

Figure 7—Correction of calculated values by using β after immersion for 30 min (▲), 210 min (■), and 7 d (♦). ○—measured data and Δ—calculated data without correction by β

Table 1 shows the values of R_s, R_f, C_f, and $f_{\theta max}$ by consideration of β in the LO system. From the results of *Table* 1 and equation (1), the relation between $f_{\theta max}$ and R_f in LO system is shown in *Figure* 7. The open circle and the open triangle plots are the measured and the calculated data and linear together. The closed triangle, square, and diamond plots are the calculated data corrected by β value after immersion for 30 min, 210 min, and seven days, respectively. The $f_{\theta max}$-R_f relation of calculated data by consideration of β (the closed plots) was more closed in comparison with that of the measured data without correction. Therefore, the $f_{\theta max}$-R_f relation is correlated by β in the real system and the relation is close to experimental one by using equation (1). Thus, it is thought that the measurement of $f_{\theta max}$ is effective as a corrosion monitor.

CONCLUSIONS

As for the real coating systems, the degradation of pigmented coating films was evaluated by $f_{\theta max}$ in electrochemical impedance measurement. The conclusions drawn are as follows:

(1) For pigmented coating films, the degradation process could be evaluated and predicted in various test periods by the measurement of $f_{\theta max}$ as well as the evaluation of degradation of nonpigmented coating films.

(2) The relation between $f_{\theta max}$ and R_f could be correlated by β in the real system and the relation is close to experimental one using equation (1).

(3) It is considered that the measurement of $f_{\theta max}$ contributes to the shortening of measuring time and the measurement of $f_{\theta max}$ is effective as a corrosion monitor.

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REVIEW PAPER

A Review of Methods Of CPVC Determination

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Chicago Society for Coatings Technology

Various experimental methods have been used to determine the critical pigment volume concentration (CPVC) of coating systems. All of them involve the making of paints formulated over a range of pigment volume concentrations (PVC) and the examination of changes in the film properties. This paper reviews some of these methods. It then goes on to review the development of mathematical models to predict the CPVC and examine some of the factors affecting the measured CPVC in latex paints.

INTRODUCTION

The critical pigment volume concentration (CPVC) of a given coating system (as defined by Asbeck and Van Loo[1] in 1949) is the point at which there is just enough binder in the dry film to coat all the pigment particles and completely fill the intervening spaces. The practical significance of determining this property is that the CPVC is a transition point—many properties of the paint undergo a marked change above the CPVC.

Bierwagen and Hay, in a 1975 paper,[2] divide the affected properties into three groups:

(1) Transport Properties—permeability, scrubbability, stain removal, corrosion resistance, blistering, enamel holdout, penetration over porous substrates, and electrical resistance. These are dependent on the flow of materials or electrical current through the coating.

(2) Mechanical Properties—flexibility, tensile strength, block resistance, glass transition temperature (T_g), scrub resistance, and cold crack resistance. These indicate the degree of resistance to external forces.

(3) Optical Properties—gloss, opacity, and tint acceptance. These are properties of the dry film's appearance.

Any of these properties may be used to determine the CPVC of a coating system, with varying degrees of success. To find the CPVC experimentally, a series of paints must be made up. The proportions of pigment and binder are varied to produce a range of pigment volume concentrations (PVC) (usually from 20-70%) and are tested. The CPVC is the point at which a curve drawn through the plotted data points shows a break or discontinuity. CPVC values determined by a variety of different techniques should fall within a narrow range of values. A mathematical method used to predict CPVC would be expected to produce results within this range. This paper will review some of the experimental and mathematical methods developed to determine CPVC.

REVIEW OF SOME EXPERIMENTAL METHODS OF CPVC DETERMINATION

As might be expected, the complexity and accuracy (and cost) of these methods varies. Drawdowns of the PVC series and a gloss meter are all that is needed to determine the CPVC by gloss measurements. As the PVC approaches the CPVC, the gloss begins to level off. One of the most complex (and expensive) methods utilizes a procedure called SLAM, or Scanning Laser Acoustic Microscopy (Chiang and Rehfeldt[3]). In this method, dry paint films are placed within an electronic system consisting of a laser scanner, a planar acoustic generator, and an acoustic scanning microscope. This system produces an "acoustic image" of the film, with air voids showing up as dark spots or bars. The PVC at which the spots or bars begin to show up is the CPVC, by definition.

A third method, developed by Cole,[4] combines graphical and computational techniques. At or below CPVC, the equation

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Table 1 — Correction Factors to Oil Absorption of Small Hiding Particles

Volume TiO_2 Percentage	Correction to Oil Absorption
0-10	−.035
11-20	−.095
21-30	−.135
31-40	−.155
41-50	−.160
51-60	−.155
61-70	−.135
71-80	−.110
81-90	−.075
91-100	−.030

$$V = V_p + V_b \tag{1}$$

describes the dry film volume of the coating, where V_p is the true pigment volume, and V_b is the binder volume. Above the CPVC, air voids introduce a relative pigment packing factor P (equal to the ratio of bulk volume to true volume). The volume equation then becomes

$$V = PV_p \tag{2}$$

Using equations (1) and (2), if a paint has theoretical volume (V) and area (A), then the thickness of the film may be calculated by substitution.

$$At_c = V_p + V_b \tag{3}$$

The actual thickness is measured and the relative deviation between the measured and calculated thickness

$$\frac{(t_m - t_c)}{t_c} \tag{4}$$

is plotted against PVC. The CPVC will be the point at which the curve intersects the PVC axis.

Using the relationships described previously, the CPVC can also be derived from the packing factor. Above the CPVC the packing factor is defined as

$$P = \frac{At_m}{V} \tag{5}$$

while at the CPVC

$$V'_b = (P' - 1)V'_p \tag{6}$$

(the ′ indicates values at the CPVC).

Remembering that PVC is defined as

$$PVC = \frac{100V_p}{(V_p + V_b)} \tag{7}$$

we may calculate the CPVC as follows:

$$CPVC = \frac{100V'_p}{(V'_p + V'_b)} = \frac{100V'_p}{(V'_p + (P' - 1)V'_p} = \frac{100}{P'} \tag{8}$$

P may be treated as a constant for small ranges of PVC values; calculating P in the neighborhood of the suspected CPVC should produce fairly uniform results. In the pigment/binder system used as an example by Cole,[5] using equation (8) produced a CPVC value of 47.8 ± 3.1.

Using the same data, CPVC can be calculated using equation (7). Below the CPVC,

$$PVC = \frac{100V_p}{V} \tag{9}$$

and at or above the CPVC

$$P = (\text{constant}) = \frac{100}{CPVC} \tag{10}$$

Therefore, the plot of

$$\frac{100V_p}{V} \quad \text{vs} \quad PVC \tag{11}$$

is a 45° line for values of PVCs less than the CPVC, and a line parallel to the PVC axis for values at or above the CPVC.

A booklet containing several experimental methods for emulsion paints was published by Tioxide of Canada, Inc., in 1980.[6] Two of their methods used porosity measurements as a litmus test for CPVC. The first of these measured the staining that occurred when a standardized solution of Gilsonite in white spirit is rubbed onto a dry paint film. The PVC at which significant staining occurs is the CPVC. An admitted problem with this method is the subjectivity of the phrase "significant staining." A visual standard would not be practical, since coatings vary widely in their acceptance of the Gilsonite stain. Also, there is the possibility that the film may be plasticized slightly by the white spirit, blurring the endpoint. With these caveats, however, the authors assessed this method to be accurate to within 5%.

A second method uses the water vapor permeability of a free film. The film is fastened across the mouth of a Paine Cup containing water. The assembly is then placed in a controlled temperature/humidity environment, and the water vapor transmission is determined. The water vapor permeability is calculated using the following equation:

$$VP = \frac{Wt}{S(R_1 - R_2)} \tag{12}$$

where W = water vapor transmission,
t = thickness of the film,
S = saturated vapor pressure at the test temperature,
R_1 = relative humidity inside the cup, and
R_2 = relative humidity outside the cup.

Water vapor permeability is plotted versus PVC. At the CPVC, there will be a marked increase in the permeability.

A third method uses the detection of air voids in free paint films (though with a much less complicated set-up than the SLAM method). It employs the equation

$$\% \text{ Air} = \frac{(d_t - d)}{d_t} \tag{13}$$

Where d is the measured density of the paint film and d_t is the theoretical density based on the composition of the coating. By measuring the density of free films at varying PVCs, it is possible to determine the point at which air voids become a significant factor, that is, the CPVC. (The calculation may be done by determining the mass of films of known area and measured thickness.)

Any method using free films requires that the films be of uniform thickness without pinholes. These constraints often pose difficulties in obtaining an accurate determination of the CPVC.

In fact, all experimental methods have their problems. Finding the exact point at which the CPVC happens is often tricky. Opacity, for example, often has no clear break at CPVC in systems with large TiO_2/extender ratios. Each method depends on making and testing a series of coatings varying only the PVC. Any results obtained are specific to the pigment/binder system involved. Therefore, a method that would allow one to mathematically calculate the CPVC based on the properties of the component raw materials would be much preferred.

A REVIEW OF MATHEMATICAL METHODS OF CPVC DETERMINATION

An early attempt to achieve a mathematical model was the use of oil absorption values to predict the CPVC. A common method of determination for oil absorption is the spatula rub method. To run this test, linseed oil is added slowly to a weighed amount of pigment while working the pigment with a spatula. When the pigment/oil mixture becomes a coherent homogenous mass, the endpoint is reached. By weighing the oil added, a ratio of oil to pigment is determined. This ratio, expressed in the amount of oil a standard amount of pigment will need to reach this endpoint, is the oil absorption of that pigment. It should be noted that this method uses the same definition for oil absorption used earlier for CPVC. At the coherent mass point, there is just enough linseed oil to satisfy the vehicle demand onto the pigment surface and fill the interstices. From the weight relationship of the oil absorption, it is a simple matter to calculate the volume relationship (CPVC) of the pigment/linseed oil system.

Early attempts to use this work for CPVC calculations assumed that the oil absorption of a mixture of pigments is the same as the sum of the oil absorptions of the individual pigments. However, experimental evidence shows that this assumption is invalid; in fact, the additive oil absorptions are strongly non-linear. Packing is very dependent on particle size and shape and the particle size distribution. This is particularly true when large particle size pigments such as duramite are mixed with small pigments like titanium dioxide. Therefore, correction factors have been developed, such as in *Table* 1 and *Figure* 1, used in the "STP 500 Method for CPVC Calculations."[7]

To use the corrections, one must know the weight (in pounds) and the volume (in gallons) of pigment in the formulation, and the oil absorption (in pounds of oil per 100 pounds pigment) for each pigment. First, determine the individual oil demands. Calculate the percent TiO_2 by volume and the total volume using equation (1) with the oil as the binder. Obtain the correction factor from the table and multiply it by the oil demand of the small particle. Subtract the product from the total oil demand (in gallons).

Using oil absorptions with the correction factor ignores the fact that several other possibly invalid assumptions are being made. The method assumes that a pigment's oil absorption is independent of the binder system, the manufacturing process, and the skill of the person running the spatula rub test. All of these assumptions are false to one extent or another. Due to this, the oil absorption method can be considered an approximation only.

Bierwagen[8] presented a model for CPVC calculation that attempted to deal with these problems. Building on Lee's work on the random dense packing of pigment particles,[9] he used Lee's algorithm to calculate a pigment packing factor for paint systems. The minimum value of this calculation is 0.639. This is at the high end of experimental values for CPVC, which Bierwagen observed to be in a range from 0.35 to 0.75. Therefore, another factor must be at work. He introduced a new correction factor based on the oil absorption data. This correction assumes that a strongly absorbed layer of vehicle coated all of the pigment particles. (In waterborne coatings, the fact that a latex is emulsified particles rather than long molecular chains would complicate this assumption.) He also made the simplifying assumption that the particles were spherical and well dispersed, and that the vehicle was uniformly absorbed on each particle. The thickness of the vehicle layer would then depend on the particle type, not the particle size. He further assumed that over the range of vehicle particle sizes used, absorption was independent of vehicle type. The effect of absorption on the random packing factor of the pigments was assumed to be negligible.

The oil absorption data values used in the study had an estimated accuracy of +/− 10%, and the particle size distribution values were of fair to good accuracy. Com-

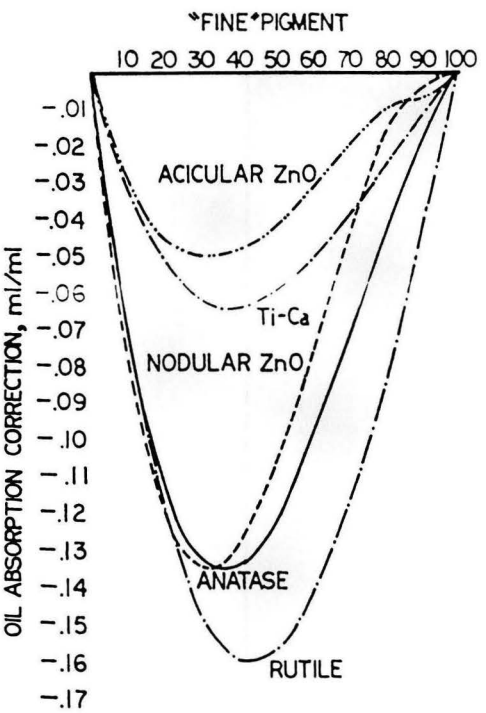

Figure 1—Oil absorption correction curves

puter calculations based on Bierwagen's method produced CPVCs that agreed well with experimentally derived results. The standard deviation between the two methods was 3.16%.

In a subsequent paper,[10] Bierwagen addressed the fact that experimental results for CPVC in latex paints often varied widely depending on the method used. Also, the apparent CPVC for any given pigmentation system was usually lower in a latex binder than in a solution polymer system. He theorized that latex paints often deviated from the "ideal" system (as postulated in his initial assumptions) in some significant way. These deviations would mask the CPVC effects, in essence lowering the observed CPVC. Factors that might produce this effect could include pigment flocculation or agglomeration and incomplete coalescence of the emulsion in the dry film. Systems with CPVCs below the theoretical value, he hypothesized, would prove to have problems with coalescence or pigment dispersion. Once these were corrected, the experimental and calculated CPVCs would agree more closely. Asbeck, in his 1977 Joseph J. Mattiello Memorial Lecture,[11] had shown that the choice of dispersant and the level of it affected the perceived oil absorption endpoint. However, Bierwagen stated that coalescence and dispersion were only second order effects.

Latexes, being particle emulsions rather than modified oils, would have some characteristics of both binder and pigment. An attempt to address this duality was the introduction of the concept of Binder Power Index (BI). This was defined by Berardi[12] as the ratio of oil volume needed to bind a pigment to the volume of a latex required to do the same. The oil factor was derived from oil absorption numbers, the latex from experimental CPVCs. The concept was still very pigment specific, however. The research of Stieg[13] and Ramig[14] further developed the concept. Mathematical adjustment of the factors based on the known properties of the latices and pigments were introduced. As a result of their work, CPVC came to be seen much more as a property of both pigment and binder.

Bierwagen,[15] in a later paper, introduced pigment binder concentration lambda (λ), (defined as PVC/CPVC). Since this factor took into account the reality of varying CPVC values, he maintained that it was a more relevant property than pure PVC for comparing paint systems. He cited the example of two coatings, both with a PVC of 50; one with a CPVC of 45, the other with a CPVC of 55. Obviously, there would be dramatic differences in their properties. It has been determined experimentally that the scrubbability and dry opacity of latex coatings with PVCs over 45 are greatly affected by the value of (λ). Empirically, the best stain penetration would occur as (λ) approaches 1.00 with a PVC of 53-55.

Bierwagen then went on to propose optimum (λ) values for certain types of coatings—for example, 0.1 for an automotive enamel, or 1.05 for a flat house paint. A table of such values would simplify starting points for paint formulation. From the experimental (or calculated) CPVC values one could determine a likely optimum PVC. Many computer programs used by large coatings companies automatically calculate PVC values for proposed formulas. Thus, once CPVC values for pigment/binder systems were known, one could eliminate possibilities that would have seemed reasonable based on similarity of PVC levels. This, Bierwagen maintained, would bring CPVC into its own as a powerful tool for the optimization of coating properties.

SUMMARY

An accurate determination of CPVC and the reduced pigment concentration (λ) are often critical in understanding coating performance and general property/structure relationships. Experimental methods of determining CPVC abound. However, they are usually labor-intensive, and the results are often influenced by other (often uncontrolled) factors. Therefore, mathematical models were evolved to calculate CPVC. Certain simplifying assumptions are necessary, but these methods produce results that agree closely with observed results. With a knowledge of the effect of CPVC on desired properties, optimum performance may be achieved.

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BIRMINGHAM ..... FEB.

"Multinational Legislation"

This meeting of the Club was incorporated in the program of the half-day symposium on "The Impact of Environmental Legislation on the Coatings Industry" held earlier in the day.

The speaker for this 481st gathering of the Club was B. Derycke, of PPG Industries Europe— Coatings and Resins Group. His topic was "How to Face Multinational Legislation—Go Beyond the Legal Requirements."

The speaker began his presentation by focusing on the increasing legislative buildup. He stated that currently there are 27 proposals in draft form, with another 34 proposals ready to be drafted shortly.

Mr. Derycke reviewed the most significant legislative developments, including environmental auditing and management, waste management, and packaging.

In conclusion, the speaker proposed the following strategy: build a consistent policy through the group; orientate product development for benefit of the customer; identify new market opportunities; plan expenses on a long-term basis; and discourage unrealistic legislative projects by convincing authorities that the proper course of action is being taken.

Also, he recommended following the principles of the American Responsible Care Program and the British Standards Environmental Management Systems groups.

Q. Has the Responsible Care Program in the U.S. improved the chemical industry's image?

A. It will take a long time, but it will reap its own rewards as a good framework for the future.

Q. Germany has some good legislation. However, a number of companies have not taken notice of this.

A. Eventually they will have to. Surprisingly, the toughest environmental laws are in Italy.

David C. Morris, *Secretary*

CDIC ..... APR.

"Colored Organic Pigments"

It was noted that Carl J. Opp, a Society Past-President, had died in 1989. He was an active member of the Society's Technical Committee and presented papers at the Federation's Annual Meeting in 1952 and 1953. A moment of silence was observed in memory of Dr. Opp.

The slate of officers for 1992-93 was announced: President—Alipio R. Rubin Jr., of Rubin Dispersions; Vice President—Paul R. Guevin Jr., of P.R. Guevin Associates; Secretary—Jeffery I. Buchman, of Akzo Coatings, Inc.; Treasurer—Alan L. Machek, of Dow Corning Corporation.

Bill M. Hollifield, of Perry & Derrick Company, Inc., was nominated to serve as the Society Representative to the Federation's Board of Directors.

It was announced that Educational Committee Chairman W. Bryn Irvine, of Palmer Supplies Company, has resigned.

A volunteer to serve as the Committee's Chairman is being sought.

The meeting's technical speaker was Society member Peter A. Lewis, of Sun Chemical Corporation. Dr. Lewis' topic was "Manufacture of Colored Organic Pigments."

The speaker described the chemistry and manufacture of organic pigments. He explained what an organic pigment is and what it is composed of—carbon, oxygen, and hydrogen as the basic structure.

According to Dr. Lewis, the majority of manufacturers of organic pigments to the coatings industry are located outside the U.S.

He stated that the industry now talks in terms of a Colour Index™ rather than a trade name pigment. This nomenclature gives a name and a constitution (a universal name).

Dr. Lewis said the *Colour Index* book is offered in seven volumes, because of the distinct markets for the publication.

Also discussed and described were the forms in which organic pigments can be supplied, including: dry, dusty toner form; and high solids and regular press cakes, an oily and polyethylene flush, and water and nonaqueous dispersions. Dr. Lewis explained the means of reducing the particle size when pigment is dispersed into a dispersion form.

The speaker defined pigments by giving detailed structures, that is, chemistry of azo, phthalocyanine blues and greens, quinacridone reds, and magenta pigments. In addition, durability, color, and uses were described in detail.

Q. Would you comment on the differences between a pigment and a dye?

A. There's a text book definition. It's the one I wrote for the Federation of Societies for Coatings Technology Series monograph on *Organic Pigments*. The easy thing to remember is that a dye is soluble in the vehicle in which it's being used. Dye stuffs dissolve; pigments don't. If your pigment is dissolving in your media, you have a problem. For example, quinacridone will dissolve in nylon. So quinacridone will not be used there because nylon is a solvent for that pigment. Pigments will always be a discrete particle.

Q. How do you distinguish between a lake and a dye?

A. Now, you get into confusing and contradictory terms. The term "lake" has a different meaning over here versus Europe. If you mean a lake is an insoluble dye, pigment scarlet is reacted with aluminum hydroxide to give you an insoluble product. Rhodamine is another example. When it's reacted with phosphorous molybdic acid, it is no longer a dye; it's a pigment. The so-

CHICAGO SOCIETY OFFICERS—The following members were elected to serve as officers and committee chairmen for the 1992-93 year (from left): Associate Representative—Jeffrey C. Chiu; Treasurer—C. David Stromberg; Secretary—Natu C. Patel; Associate Representative—Lori Hilson Gaede; Patricia J. McGrath; President—William W. Fotis; Vice President—Gregory McWright; Past-President—Theodore J. Fuhs; and Society Representative—Evans Angelos

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Willow Grove Restaurant, Linthicum, MD). JOHN KURNAS, Mineral Pigments Corp., 12116 Conway Rd., Beltsville, MD 20705.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). D.C. MORRIS, PPG Industries (UK) Ltd., P.O. Box 359, Birmingham, B16 0AD, England.

CDIC (Second Monday—Location alternates between Columbus, Cincinnati, Dayton, and Indianapolis). PAUL R. GUEVIN, JR., P.R. Guevin Associates, P.O. Box 811, Westerville, OH 43081-0811.

CHICAGO (First Monday—Sharko's Restaurant, Villa Park, IL). GREGORY E. MCWRIGHT, ANGUS Chemical Co., 2911 Sanders., Northbrook, IL 60062.

CLEVELAND (Third Tuesday—Brown Derby, Independence, OH in Sept., Oct., Nov., Dec., Feb., March; Jan. and Apr. meetings, Landerhaven, Mayfield Heights, OH). FREIDUN ANWARI, Coatings Research Group, Inc., 2340 Hamilton Ave., Cleveland, OH 44114.

DALLAS (Thursday following second Wednesday—The Harvey Hotel, Dallas, TX). ROBERT GIBNEY, Kerr-McGee Chemical Corp., P.O. Box 565026, Dallas, TX 75212.

DETROIT (Second Tuesday—meeting sites vary). RON ANDRUS, BASF Corp., 5935 Milford Ave., Detroit, MI 48210.

GOLDEN GATE (Monday before third Wednesday—alternates between Francesco's in Oakland, CA, and Holiday Inn in S. San Franscisco). DONALD NOLTE, John K. Bice Co., 280 Missouri St., San Francisco, CA 94107.

HOUSTON (Second Wednesday—Hobby Airport Hilton, Houston, TX). RICHARD W. RYAN, Exxon Chemical Co., P.O. Box 5200, Baytown, TX 77520.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). YVONNE D'ARCY, Cook Paint & Varnish Co., P.O. Box 419389, Kansas City, MO 64141.

LOS ANGELES (Second Wednesday—Steven's Steakhouse, Commerce, CA). PHILIP C. BREMENSTUHL, Ashland Chemical, Inc., 999 Town & Country Rd., Orange, CA 92668.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). MIKE R. MOILANEN, United Catalysts, Inc., P.O. Box 32370, Louisville, KY 40232.

MEXICO (Every fifteen days—Gabriel Mancera, Mexico City, Mexico). SERGIO ROJAS, Pinturas International, S.A. De C.V., Ganaderos 234, Col. Granjas Esmeralda, 09810 Mexico, D.F., Mexico.

MONTREAL (First Wednesday—Le Biftheque, Ville St. Laurent, Quebec). JACQUES BROUILLETTE, ICI Paints (Canada), Inc., 1470 Nobel St., Boucherville, Que., J4B 5H3, Canada.

NEW ENGLAND (Third Thursday—Sheraton Lexington Hotel, Lexington, MA, alternate meetings twice a year in Sturbridge, MA and Providence, RI). JOANNE E. MONIQUE, Ashland Chemical Inc., 400 Main St., Tewksbury, MA 01876.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). ARMAND J. STOLTE, RHEOX Inc., P.O. Box 70, Hightstown, NJ 08520.

NORTHWESTERN (First Tuesday after first Monday—Jax Cafe, Minneapolis, MN). SARAH OEBSER, H.B. Fuller Co., 3530 Lexington Ave., N., St. Paul, MN 55126.

PACIFIC NORTHWEST (PORTLAND SECTION—Third Tuesday; PUGET SOUND SECTION—Third Wednesday; VANCOUVER SECTION— Third Thursday). FLORA WONG, Saguaro Ltd., 106-150 E. Fifth St., N. Vancouver, B.C., V7N 1L5, Canada.

PHILADELPHIA (Second Thursday—Williamson's Restaurant, GSB Bldg., Bala Cynwyd, PA). BRIAN O'CONNOR, McWhorter Resins, Inc., 7600 State Rd., Philadelphia, PA 19136.

PIEDMONT (Third Wednesday—Ramada Inn Airport, Greensboro, NC). DENNIS GILLESPIE, Lomas Minerals and Chemicals, P.O. Box 605, Indian Trails, NC 28079.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). TIMOTHY ZEFFIRO, J.M. Gillen Co., P.O. Box 588, Bridgeville, PA 15017.

ROCKY MOUNTAIN (Monday following first Wednesday—Zangs Brewery, Denver, CO). LOUIS HARTNELL, Mountain-West Resources, Inc., P.O. Box 16784, Denver, CO 80216.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant, St. Louis, MO). MICHAEL SCHNURMAN, Kop-Coat, Inc., 328 Henley Ind. Ct., St. Louis, MO 63144-1599.

SOUTHERN (GULF COAST SECTION—third Thursday; CENTRAL FLORIDA SECTION—third Thursday after first Monday; ATLANTA SECTION—third Thursday; MEMPHIS SECTION—bimonthly on second Tuesday; and MIAMI SECTION—Tuesday prior to Central Florida Section). MARY G. FINNIGAN, McCullough & Benton, Inc., 2900 G Carolina Center, Charlotte, NC 28208.

TORONTO (Second Monday—Cambridge Motor Hotel, Toronto). DAVID JACK, Technical Coatings Co Ltd., 1164 Walkers Ln., Burlington, Ont., L7M 1V2, Canada.

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

dium form of metallized azo dyes are quite soluble. When the sodium is displaced with a massive amount of calcium, barium, or manganese, depending upon the end product, you make it into a pigment. Laked pigments used in the cosmetic industry are pigments extended with an inorganic extender, like talc, so you have 70% pigment and 30% talc. I would prefer to use the term "toner."

The meeting's educational speaker was Mike Delaney, Area Supervisor for Primate Animals at the Cincinnati Zoo. His presentation was entitled "A KEEPER AT THE CINCINNATI ZOO."

PAUL R. GUEVIN JR., *Secretary*

CHICAGO ..... APR.

"Pigment Wetting"

Elected to serve as Society Officers for 1992-93 are: President—William W. Fotis, of The Valspar Corporation; Vice President—Gregory McWright, of ANGUS Chemical Company; Secretary—Natu C. Patel, of Ace Hardware Corporation; Treasurer—C. David Stromberg, of Standard T Chemical; Membership Committee Chairman—Steve A. Hodges, of Halox Pigments; and Associate Representative—Lori Hilson Gaede, of T.H. Hilson Company.

Evans Angelos, of OMYA, Inc., was elected to serve as the Society Representative to the Federation's Board of Directors.

New York Society member Andrew A. Romano, of Drew Industrial Division of Ashland Chemical, discussed "PIGMENT WETTING AND DISPERSING."

The speaker explained the principles of pigment wetting and dispersing theory, mechanisms, and technology. He reviewed the traditional dispersants and compared them to several new technologies.

Also, Mr. Romano discussed the features and benefits of various commercial and experimental dispersants.

CLIFFORD O. SCHWAHN,
Publicity

CLEVELAND ..... MAR.

"Drier Systems"

Nominations for Society Officer positions for the 1992-93 year were announced: President—Roy A. Glover, of The Mahoning Paint Corporation; Vice President—Freidun Anwari, of Coatings Research Group, Inc.; Secretary—Constance F. Williams, of The Glidden Company; Treasurer—Michael A. Wolfe, of Seegott, Inc.; Assistant Treasurer—Richard A. Mikol, of Tremco, Inc.; and Member-at-Large—Robert L. Toth, of The Glidden Company.

Brenda L. Carr, of Coatings Development Company, was nominated to serve as

the Society Representative to the Federation's Board of Directors.

"DRIER SYSTEMS FOR HIGH SOLIDS COATINGS" was presented by Marvin Landau, of Hüls America, Inc.

The speaker stated that, currently, the paint and coatings industry is undergoing a dramatic reformulation of solvent-based coatings to meet federal, state, and local solvent emission restrictions. He emphasized that the restrictions are expected to become even more stringent in the future.

According to Mr. Landau, the National Paint and Coatings Association has requested Congress adopt a national law whereby the paint and coatings industry would reduce VOC emissions by 25% in five years; in effect, this would impose the existing California standards nationwide.

As a result, a new generation of longer oil, lower molecular weight alkyd resins has been developed. Also, the speaker said that these resins require "new" drier combinations.

Mr. Landau stated that many of the low VOC alkyd drier recommendations from the alkyd manufacturers use excessive levels of "standard" driers which can impart surface tackiness, wrinkling, poor through dry, and/or film discoloration.

In conclusion, the speaker presented a number of generalizations. First, low VOC alkyds are substantially different from standard alkyd resins and can be different from each other. Second, drier recommendations for standard alkyd resins are not satisfactory for low VOC alkyds. Third, early drier recommendations from the low VOC alkyd manufacturer were high in cost and did not provide adequate dry or satisfactory film properties. Also, newer drier recommendations using unique multimetallic driers show an improvement in all of these areas. Fourth, further improvements are anticipated in low VOC alkyds and driers for these systems to be made by their respective manufacturers in the next few years. Fifth, the coatings industry has always been dynamic and innovative and is expected to meet the changing market and regulatory needs for alkyd-based coatings.

Q. Is there renewed interest in water-reducible alkyds for trade sales coatings? If so, what problems exist?

A. Yes, newer systems claim to have greater shelf stability. Previous systems were very unstable; pH adjustment was critical.

Q. In Europe, several "exotic" driers are used which are not available in the U.S. Will these driers become available in the future?

A. Probably not because of government regulations. Barium and strontium driers are used extensively in Europe; however, in the U.S., they would be avoided because of their heavy metal content.

FREIDUN ANWARI, *Secretary*

LOS ANGELES.....APR.

"Waterborne Coatings"

A motion was approved to raise the Society annual dues to $75 per member effective September 1, 1992.

Environmental Committee Chairman Dave Muggee, of E.T. Horn Company, reported on the changes in the Toxics Release Inventory Form R, which is part of SARA III Section 313, Emergency Planning and Right-to-Know. He said the White House Office of Management and Budget has rejected the current Form R because it disagrees with the Environmental Protection Agency on: the waste stream definition; the removal of energy recovery as a form of recycling; the data required on source reduction which goes beyond the law; and the number of toxic release inventory chemicals required for reporting under source reduction.

Mr. Muggee stated that chemical manufacturers are concerned about the deadline (July 1) because, as of the date of this meeting, they have not received the information pack from the government.

Also, he reported that the Ninth Circuit U.S. Court of Appeals upheld an earlier ruling which found that a company that had sent raw materials to a formulator, but retained title to the materials throughout the formulation process, was liable for cleanup cost under the Comprehensive Environmental Response Compensation and Liability Act.

In other news, Mr. Muggee noted that the Storm Water Permitting Group Monitoring Plan is being implemented. Approximately 40 companies have signed up. The contract language is being negotiated between Environmental Services and Engineering (ESE) and Matt Dustin, CPC. ESE is preparing a time schedule for the work.

It was announced that the Board of Directors has established a Public Relations Committee. Anyone wishing to serve on the committee should contact Society Vice President Sandra L. Dickinson, of Synergistic Performance Corporation.

Richard Johnson, of Cargill, Inc., presented a talk on "NEW DEVELOPMENTS FOR WATERBORNE COATINGS." Mr. Johnson is a member of the Northwestern Society.

The presentation began with a review of the results from a survey which asked coatings chemists to identify technology which they used to solve problems prior to 1991 and to predict the technology they anticipated using in 1993.

Mr. Johnson said the results showed that conventional technology for solving problems was expected to decline from 42 to 26% by 1993. However, the use of waterborne and two-component technology was supposed to increase from 21 to 30% and 9 to 13%, respectively, in the same timeframe. High solids technology was not expected to grow beyond its 16% use in 1990.

The survey disclosed that coatings chemists in California anticipated more rapid change, while respondents from the Northeast looked for changes at a pace slower than the national average.

Mr. Johnson described water-based systems with less than 250 VOC for air-dry and baking coating with resistance properties of conventional coatings.

The speaker also noted that a water-reducible polyolefin has been developed for a water stain which has good stability, excellent penetration into porous surfaces, and easy water clean up.

Q. What anticorrosion pigments can you use with waterborne coatings without affecting stability?

A. The combination of zinc phosphate with pigments ZBO and ZBA and some proprietary additives will give stable formulations with synergistic performance properties.

Q. How do you stabilize (shelf life) an air-dry water-reducible resin when you use an anticorrosive pigment?

A. Currently, there is a balance between water solubility of the resin and its reactivity with anticorrosive pigments. We have obtained our best results with zinc phosphate combinations.

Q. What depth of penetration can you expect from the water-reducible polyolefin compared to that of a conventional linseed oil stain?

A. Spread of the water-reducible stain on filter paper is about 500%. This is similar to the spread of a linseed oil stain. Viscosity is an important factor in controlling stain spread.

PHILIP C. BREMENSTUHL, *Secretary*

PIGMENT WETTING—Andrew A. Romano addresses attendees at the Chicago Society April meeting

Elections

CDIC

Active

Nogueira, Andrew—Hunting Industrial, Cincinnati, OH.

Associate

Lowe, Don C.—Van Waters & Rogers, Dayton, OH.

CLEVELAND

Active

Adams, Jeffrey L.—GE Lighting, Cleveland, OH.
Anthony, Robert D.—Man-Gill Chemical, Bedford, OH.
Barry, Jennifer I.—GE Lighting, Cleveland.
Butler, Kurt I.—Premix Inc., North Kingsville, OH.
Coffman, James R.—Redspot Paint & Varnish, Plymouth, MI.
Coss, Jolaine L.—Avery Dennison-MAPF, Painesville, OH.
Emser, Ronald R.—Engelhard Corp., Beachwood, OH.
Kosior, Matthew A.—American Colors Inc., Sandusky, OH.
McClure, Denice A.—Premix Inc., Geneva, OH.
Story, Donald G.—Engelhard Corp., Beachwood.
Sumerak, Joseph E.—Pultrusion Technology, Twinsburg, OH.
Worobiec, Bruno W.—Sheffield Bronze Paint, Cleveland.
Woyansky, Jeannine A.—GE Lighting, Cleveland.

Associate

Boulden, Robert H.—Oxychem-Petrochemical, Rocky River, OH.
Stasen, Edward R.—The Hall Chemical Co., Wickliffe, OH.
Whittaker, James E.—Thor Chemicals, Norwalk, CT.

NORTHWESTERN

Active

Nothnagel, Joseph L.—Cargill, Inc., Maple Grove, MN.

Associate

Kotnik, Julie M.—The Lubrizol Corp., Wickliffe, OH.

PACIFIC NORTHWEST

Active

Jang, Taeyoung—Willamette Valley Co., Eugene, OR.
Lewis, Brian K.—Cork Industries Inc., Olympia, WA.
Peterson, James E.—Wiltech Corp., Longview, WA.
Walker, Ted D.—Fuller Brothers Inc., Clackamas, OR.

Associate

Cebula, Casey M.—Manufacturing Business Systems, Seattle, WA.
Siciliano, Brenda A.—Ashland Chemical Co., Portland, OR.

PHILADELPHIA

Active

Corajo, Bernadette R.—Rohm and Haas Co., Spring House, PA.
Erickson, Joshua A.—Stonhard, Inc., Maple Shade, NJ.

Associate

Hathaway, Julie A.—Reichhold Chemicals, Cinnaminson, NJ.

PITTSBURGH

Active

Hartin, Richard M.—Matthews International, Pittsburgh, PA.
Hicks, Sharon D.—Miles Inc., Pittsburgh.
Kamarchik, Peter—PPG Industries, Inc., Allison Park, PA.
Mathes, H. Dennis—PPG Industries, Inc., Springdale, PA.
Watson, H. Knox III—Watson Standard Co., Pittsburgh.

Associate

McCulloch, Donald A.—Chemply Div. of E&E, Pittsburgh, PA.
Steen, James B.—Dar-Tech, Inc., Pittsburgh.
St. Jean, Steven B.—Palmer Supplies Co., Cleveland, OH.

TORONTO

Active

Barlow, David M.—Valspar Inc., West Hill, Ont.
Berry, Gordon D.—Knoll North America, Woodbridge, Ont.
Noonan, John K.—Dow Chemical Canada, Etobicoke, Ont.
Salin, Vail O.—Chempro Coatings Ltd., Thornhill, Ont.
Wolinsky, Steve M.—Tremco Ltd., Toronto, Ont.

Associate

Kfoury, Fawzi J.—Tomen Canada Inc., Toronto, Ont.
Rothwell, Bianca—Shell Canada Chemicals, North York, Ont.
Sagara, Ruby K.—Marubeni Canada Ltd., Toronto.
Sarhan, Hani D.—Dominion Colour Corp., Mississauga, Ont.
Thiemann, Doug P.—Prilco Inc., Mississauga.

People

Ranbar Technology Inc., Glenshaw, PA, has named **Richard Marci** Technical Director and Manager of the Technical Department. Mr. Marci joined Ranbar in 1987 as Product Development Manager. He served as President of the Pittsburgh Society in 1989.

R. Marci

Eliezer Hargil has been named Managing Director of Witco Ltd., Witco Corporation's 60% owned subsidiary in Israel. He replaces **Isak Katz**, who retired after a 37-year career with the company. Mr. Hargil had been Deputy Managing Director of Witco Ltd., responsible for the development of the industrial products group since 1985. Witco Corporation is headquartered in New York, NY.

DeVilbiss Ransburg Industrial Liquid Systems, Toledo, OH, has promoted **Dan Carney** to Manager of Systems Engineering. In this position, Mr. Carney will manage and direct the activities of the company's project managers, application engineers, service technicians, demonstration lab, and training. Prior to joining DeVilbiss, he was Director of Engineering Services for Graco Robotics.

In addition, **Jim Talkington** has accepted the position of Technical Service Representative for DeVilbiss. In this capacity, Mr. Talkington will provide enhanced customers service training, specializing in manual electrostatic systems. He has been with the company since 1988.

Lisa A. Westerfield has been appointed Manager of Business Development/Trade Sales Colorants within the Colorants and Additives Division of Hüls America Inc., Piscataway, NJ. In this position, Ms. Westerfield will be responsible for developing marketing strategies for the company's ethylene glycol-free colorants. She has been with Hüls since 1986.

L.A. Westerfield

Frank W. Harris, Professor of Polymer Science and Biomedical Engineering, was named the 1991-92 Outstanding Researcher by The University of Akron (UA), Akron, OH. Dr. Harris joined UA in 1983. His interests include polymer synthesis via step-growth polymerizations, structure and property relationships in high performance polymers, and polymeric controlled-release systems.

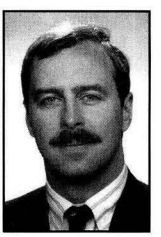
Frank G. Vosnick has been named Director of the newly restructured Adhesives and Sealants Business Unit of PPG Industries, Inc., Pittsburgh, PA. Mr. Vosnick has been with PPG for 24 years and most recently served as Business Unit Manager in the Automotive Coatings Marketing Unit. He will be responsible for North American production activities as well as global research, development, and marketing for the unit.

Rick Winterson has accepted the position of Business Manager of the Monomers Division of Rohm Tech Inc., Malden, MA. His duties will include business management, sales and marketing for the company's specialty chemical lines, specifically monomers, polyurethanes, enzymes, and advanced materials. Prior to joining Rohm Tech, Mr. Winterson owned Mesotrends, an engineering consulting firm for the chemical industry.

The promotion of **Kent S. Strong** to the position of Vice President of Sales has been announced by ANGUS Chemical Company, Northbrook, IL. Mr. Strong will oversee all U.S. and Canadian sales of of the company's nitroparaffins, their derivatives, and biocides.

Brian M. Bailey has been named Vice President/Finance for the Macbeth Division of Kollmorgen Instruments Corporation, Newburgh, NY. Mr. Bailey will assume responsibilities for all aspect of the company's financial and systems activities.

Barney Heller has accepted the position of Market Development Manager for Melamine Chemicals, Inc., Donaldsonville, LA. Mr. Heller has more than 10 years of domestic and international experience in specialty chemical market development with W.R. Grace. In this new post, he will manage support for customers throughout North America from his Boston, MA, office. In addition, Mr. Heller will service selected melamine accounts in New England and Canada.



B. Heller

Dr. Frederick G. Cottrell Inducted Into Inventors Hall of Fame

Dr. Frederick G. Cottrell, founder of Research-Cottrell, Inc., Branchburg, NJ, and inventor of the electrostatic precipitator, was inducted into the Inventors Hall of Fame on April 25, 1992. He joins such prominent inventors as Thomas A. Edison, Gugliemo Marconi, Eli Whitney, and the Wright brothers.

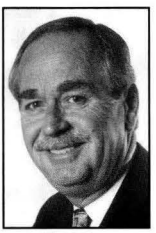
At the turn of the century, paper mills, power plants, smelters, and industries were facing opposition from municipalities because of escaping gases and sometimes-poisonous dust and fumes. Determined to alleviate this pollution problem and to prevent valuable raw materials from being released into the atmosphere, Dr. Cottrell began experimenting with electric precipitation.

In 1907, he applied for a patent on the first electrostatic precipitator, a device that passed high-voltage direct current through a conductor or electrode, which leaked the charge onto particulates in the passing fumes. The charged particulates were then electrically attracted to another nearby electrode, where they collected and could be retrieved as valuable minerals or chemical compounds.

The electrostatic precipitator, known also as the Cottrell, removed between 90 and 98% of all particles from escaping smoke and gases. In 1912, Dr. Cottrell founded the Research Corporation, a nonprofit corporation that returned money from inventions back into the advancement of science; Research-Cottrell was spun from this organization in the 1950s.

Amoco Chemical Company, Chicago, IL, has appointed **Charles E. Wilks** Vice President. Mr. Wilks joined Amoco's Decatur, AL, plant in 1966 as a Process Engineer. He most recently served as President of Performance Products. Replacing Mr. Wilks as President of Amoco Performance Products is **Richard L. McNeel**. Mr. McNeel most recently served as Vice President of Performance Products.

Datacolor International, Lawrenceville, NJ, has appointed **Ron Baker** Divisional Sales Manager/Western United States, Latin America, and the Caribbean. In this position, Mr. Baker will have overall responsibility for area managers and representatives in the western U.S., the Ohio Valley, and the Midwest. He will also be responsible for directing sales in Latin America and the Caribbean.



R. Baker

The Dexter Corporation's Packaging Products Division, Waukegan, IL, has named **Peter V. Ferris** Market Manager/End Sealants. Mr. Ferris transferred to the division from Dexter's corporate offices in Windsor Locks, CT.

Also, **Beth Smith** has been appointed Customer Satisfaction Coordinator at the division's manufacturing center in Birmingham, AL. A five-year Dexter employee, Mrs. Smith's most recent position was Customer Service Representative at Evodex, a Dexter Automotive Division joint venture company.

In addition, **Chalmer G. Wayland** has been named Plant Accountant of the Birmingham facility. In this capacity, Mr. Wayland will oversee all accounting functions from month end close to financial software applications and supervisory responsibility for bookkeeping.

Richard Burgess, formerly with Pittsburgh Testing Laboratory, has joined the staff of KTA-Tator, Inc., Pittsburgh, PA. At KTA, Mr. Burgess will perform consulting duties in the area of lead-based paint removal, and management assistance on both housing and industrial lead paint projects. He bring over five years of coatings-related experience to the company.

Also, **Frank Stoner** has joined the consulting staff of KTA. He will be working primarily with coil coaters and users of prepainted metal coil on performance specification, analysis of coating failures, quality control test procedures, and coating performance evaluations.

Obituary

Carl Opp, Past-President of the CDIC Society (1956-57), died November 11, 1989. He was 85-years old.

Dr. Opp graduated from Miami (Ohio) University with the A.B. Degree in 1928. He performed his graduate work at the University of Cincinnati, receiving the A.M. Degree in 1930 and the Ph.D. Degree in Chemistry in 1932. Upon graduating, Dr. Opp served as head of the Science and Math Department of Armstrong J. College before accepting faculty positions at Beckley College and Duke University.

Dr. Opp joined Interchemical Corporation (now BASF Corporation) in 1939 where he researched phenolic, alkyd, and urea-formaldehyde resins for production and eventual industrial applications. He was a Synthetic Resin Research Chemist and Group Leader at Interchemical until his retirement in 1974. Following his retirement, Dr. Opp joined C.L. Zimmerman Company and remained with them until 1985.

In addition to being a Past-President of the CDIC Society, Dr. Opp was Chairman of the Society Technical Committee (1952-54) and presented two constituent society papers at the Federation's Annual Meeting.

Elwood (Woody) Pease, retired Technical Director of Paint America Company/Warehouse Paint Centers, Dayton, OH, died March 6, 1992. He was 62-years old.

Mr. Pease graduated in 1951 from Milton College and began his industrial career with S.C. Johnson Company, Racine, WI. In 1956, he left S.C. Johnson to attend North Dakota State University where he received the M.S. Degree in Protective Coatings/Chemistry in 1959. Upon graduation, he was employed by The Valspar Corporation, Rockford, IL (1956-66); Mautz Paint Company, Madison, WI (1966-77); and Hoffer's, Inc., Wausau, WI (1977-86), before becoming Technical Director at Paint America.

Mr. Pease was a member of the CDIC Society, and served as Chairman of the Society's Technical Committee from 1989-91.

He is survived by his wife, Zelpha; two sons; a daughter; two grandchildren; and his father.

Geneva H. Wells, Vice President of H.M. Royal of California, Inc., died April 26, 1992.

Ms. Wells was a long-time member of the Los Angeles Society and served as Chairman of the Western Coatings Societies' Biennial Symposium and Show.

G.H. Wells

George Claytor, former St. Louis Society Member, died March 8, 1992. He was 84-years old.

Mr. Claytor joined the industry in 1927 as an employee with Warren Paint & Color Company, Nashville, TN. He later worked for Alabama Paint Company, Birmingham, AL; H.R. Carroll Paint Company, Memphis, TN; Morris Paint and Varnish Company, E. St. Louis, IL; Staley Paint Company, St. Louis, MO; and H.A. Baumstark Company, St. Louis. At the time of his retirement in 1976, Mr. Claytor was a Salesman for Walsh & Associates in St. Louis.

In addition to being a member of the St. Louis Society, Mr. Claytor was also a member of the St. Louis Paint and Coatings Association.

Impact of Environmental Legislation on Coatings Industry Theme of Birmingham Club's Symposium

Approximately 80 people attended the Birminghan Paint and Varnish Club's one-half day symposium on "The Impact of Environmental Legislation on the Coatings Industry," held on February 6, at the Strathallan Thistle Hotel, in Edgbaston, Birmingham, England.

The conference reviewed current environmental legislation affecting the coatings industry and considered the legislation's impact on the industry. The symposium began with an overview on legislation by the Paintmakers Association. Details of current regulations were presented by the Department of the Environment, and coping with legislation was described. A thorough review of the European community and its influence on future legislation concluded the symposium.

The speakers and their topics for the symposium included:

A.J. Newbould, Deputy Director of the Paintmakers Association of Great Britain Ltd. Mr. Newbould's talk was on "How Environmental Protection Legislation Is Changing the Coatings Industry";

Gary Tringham, of the Department of the Environment (Local Authority Unit). Mr. Tringham's topic was "A Review of the Current Legislation and Its Implementation";

David Chadderton, Environmental Affairs Manager, of ICI Paints. Mr. Chadderton reviewed "How a Paint Company Is Dealing with the Legislation"; and

Howard Myers, of Leigh Environmental Ltd. His topic was "Waste Management—The Phoenix from the Ashes."

Club Technical Committee Chairman Roland L. Staples, of Nortax, was the symposium moderator.

SYMPOSIUM SPEAKERS—Speakers and Birmingham Club officers together at the "Environmental Legislation" symposium include (from left): Gary Tringham; Howard Myers; Bernard DeRyore, of PPG Industries France S.A.; President Robert McD. Barrett; Technical Committee Chairman Roland L. Staples; A.J. Newbould, and David Chadderton

Latex and Rheology Presentations Highlight Philadelphia Society Technical Committee Seminar

The Technical Committee of the Philadelphia Society for Coatings Technology presented a seminar on "Latex and Rheology: Interactions between Latex and Associative Thickeners," on May 11, at the Airport Hilton Inn, in Philadelphia, PA.

A total of seven presentations were conducted during the one-day long conference. Featured topics and speakers were as follows:

"Thickening Mechanisms in Water-Based Coatings"—Hemi N. Nae, of Rheox, Inc.;

"Selecting and Using Associative Thickeners"—Edward J. Schaller, of Rohm and Haas Company;

"Interaction of Associative Cellulosic Thickeners with Surfactants in Latex Paints"—Richard G. Brown, of Aqualon Company;

"Polymer Blends with Natural and Synthetic Clays"—Carl J. Bauer, of Southern Clay Products, Inc. (a Laporte Company);

"Improved Rheological Characteristics of Water-Reducible Formulations with Hydrophobic Fumed Silicas"—Maria Nargiello, of Degussa Corporation;

"Rheology of Polystyrene Latex Dispersions that Contain Model Associative Polymers and Sodium Dodecyl Sulfate"—C.A. Silebi, Lehigh University; and

"Novel PolyetherPolyol (PEPO) Associative Rheology Modifiers for Latex Coatings"—David Bryant, of Rheox, Inc.

The Seminar Committee included Technical Committee Chairman Julio Aviles, of Kronos, Inc.; Technical Committee Secretary Neil Shearer, of 3E Group; and Registration Chairman Barry Fisher, of Van Horn, Metz & Company.

Perkin-Elmer to Sponsor Third Technical Paper Award

The Perkin-Elmer Corporation, Norwalk, CT, has announced that applications are now available for their third annual International Liquid Chromatography Technical Paper Award. The papers will be judged by an independent panel of academic, industry, and media liquid chromatography experts.

The technical content of submitted papers is unrestricted as long as the analytical technique used is liquid chromatography, and there is reference to a liquid chromatography system from any manufacturer. Also, papers published within the last year are eligible.

The deadline for submitting papers for the award is January 1, 1993. The winners will be announced in May 1993.

To obtain an official entry form and more information, contact: Laura Lauman, The Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0250.

Golden Gate Society Manufacturing Committee Hosts Conference on Environmental Regulations

On June 15, the Manufacturing Committee of the Golden Gate Society for Coatings Technology hosted a conference entitled, "The Forum . . . Ideas for the Future," at the Holiday Inn, in South San Francisco, CA.

The program was divided into three parts: environmental regulations, solutions to problems created by regulations, and legal rights of companies affected by environmental regulation.

The following environmental-related topics were presented:

"SB198—Injury and Illness Prevention Program"—Cecelia Stoddard, of Fuller O'Brien Paint Company;

"Permit by Rule"—Gerald B. Allen, of Eastman Kodak Company;

"Hazardous Waste Management in the Paint Industry"—Darren Bianchi, of Radiant Color;

"Regulations for the Recycling of Latex Paint"—Patricia Houle, of Fuller O'Brien Paint Company;

"Container Recycling"—Bob Jacobsen, of U.S. Can;

"Methods for Recycling Paint Waste"—Robert Athey, of Athey Technologies;

"Emission Control and Waste Management"—Bill Marlin, of Kleinfelder Inc.; and

"Fuming over Regulations? How to Survive the Onslaught of New Hazmat Legislation and Enforcement Initiatives"—Jonathan W. Redding, of Fitzgerald, Abbot, and Beardsley.

In addition a panel discussion on "Cooperation within the Law" was held. Members of the panel included: Roy Blackburn, of Flecto Company; Paul Gasner, of Simpson Coatings Group; Dave Muggee, of E.T. Horn Company; Rocky Williams, of Napa Valley Paint; and Frederick Parkinson, of U.S. Cellulose Company.

Members of the Golden Gate Manufacturing Committee responsible for making the conference a success include: Chairman Louie F. Sanguinetti, of Jasco Chemical Corporation; Co-Chairman Ronald Hughes, of Ashland Chemical Company; Co-Chairman Ernest "Bud" Harmon, Consultant; Adrian Adkins, of Schoofs, Inc.; Ray Benedetti, of Triangle Coatings; Robert A. Henshaw, of Hüls America, Inc.; Don Mazzone, of The O'Brien Corporation; Tina Onderbeke, of Dowd & Guild, Inc.; Kevin D. Porterfield, of Pfizer, Inc.; A. Gordon Rook, Consultant; Leo Schinassi, Consultant; Kendall E. Trautwein, of Triangle Coatings, Inc.; and Rocky Williams.

Powder Coating '92 Slated for October 6-8

Powder Coating '92, sponsored by The Powder Coating Institute, is scheduled for October 6-8, at the Cincinnati Convention Center, Cincinnati, OH.

Highlighting the event will be a trade show featuring more than 150 exhibitors, general conference sessions, and six interactive workshop sessions. The workshops will include pretreatment, system design, measurement of film characteristics, troubleshooting, health and safety considerations, and strategic planning for custom coating operations.

For more information on Powder Coating '92, write Goyer Management International, 8072 Beechmont Ave., Cincinnati, OH 45255.

The Adhesion Society to Grant Student Aid For Annual Meeting and Short Course

The Adhesion Society, Inc., has announced that partial funding is available for deserving graduate students to attend its 1993 Annual Meeting on February 21-26, in Williamsburg, VA. Also, aid is available for students to attend the Annual Short Course on Adhesion at the meeting in Williamsburg.

The guidelines for provision of aid are as follows:

—Aid is available to any graduate student in the world who is past his/her first year of graduate study and who will still be enrolled in graduate school at the time of the Annual Meeting for which aid toward attendance is sought.

—The selection of students will be made on the basis of a long abstract of a Poster Paper to be presented at the 1993 Annual Meeting. Judging of the paper can be on the basis of the following criteria: timeliness and relevance of the work to the field of adhesion; clarity of statement of the problem; soundness of approach; and quality and quantity of supporting data which permits assessment of progress toward solution of the problem.

—The material presented for consideration must not be a research proposal but a long abstract based on the student's own work to date. The abstract must consist of no more than three pages of typewritten material plus reference and figures.

—Proposals must be submitted by October 1, 1992.

—The abstracts will be judged and ranked by a committee of three Society members appointed by the President. This committee will consist of one member from each of academia, government, and industry. The committee will report to the President its rank ordering of the proposed poster papers by November 1.

The President will inform the winning students and their advisors within seven days of notification by the committee of its ranking of the students, but no later than November 15.

Only partial support will be granted, that is, the student and/or advisor will be required to make a financial commitment toward the student's attendance. The amount of support granted to each student will not exceed the lesser of $500 or one-half of the student's anticipated expenses for attending the meeting. The number of students to whom aid will be extended for any given Annual Meeting will be at the discretion of the Executive Committee of the Society upon their consideration of the financial condition of the Society. For students to whom aid is granted, registration fees for attendance at both the Annual Meeting and annual short course will be waived.

For further information, contact Professor F.J. Boerio, President, The Adhesion Society, Inc., Dept. of Materials Science and Engineering (ML 12), University of Cincinnati, Cincinnati, OH 45221.

Industrial Color Seminars Scheduled for 1992

Datacolor International, Lawrenceville, NJ, has announced its schedule for the 1992 Industrial Color Technology Seminars.

The program focuses on practical color problem solving in industrial applications with an eye toward providing fresh insights on new techniques. Seminar topics include: colorimetry and factors affecting color, spectrophotometry and metamerism, colorant characteristics and elements of formulation, color differences, Kubelka-Munk Turbid Theory application, and more.

Lecturer for the color seminar is Ralph Stanziola, of Industrial Color Technology.

The dates and locations for the course are as follows: August 27-28—Los Angeles, CA; October 19-20—Chicago, IL; November 18-19—Dallas, TX; and December 2-3—Charlotte, NC.

For more information, contact Betsy Mengel, Marketing Dept., Datacolor International, 5 Princess Rd., Lawrenceville, NJ 08648.

Detroit Colour Council To Meet in Fall

The Detroit Colour Council will meet on September 23, at the Michigan State University Management Education Center, in Troy, MI. The topic for the meeting will be "New Pigments."

The conference will serve as a forum for the presentation of new color technology as its relates to fiber and textile, plastics, and paint in the automotive industry. Papers by industry experts on new colors submitted by color producers are scheduled during the meeting. Talks will be presented by personnel from the automotive paint, fiber and textile, and the plastics industry.

All pigment or dye companies which have introduced new products for the automotive color business and are interested in participating in the meeting should contact: Richard Hamilton, EM Industries, Inc., 801 W. Big Beaver Rd., Ste. 455, Troy, MI 48084 by August 15.

For more details, contact program moderator James Hall, General Motors Corp., 30009 Van Dyke, Warren, MI 48090.

CALL FOR PAPERS

20th Annual Waterborne, Higher-Solids, And Powder Coatings Symposium

Sponsored by Southern Society for Coatings Technology and University of Southern Mississippi

February 24-26, 1993 New Orleans, LA

All prospective authors are invited to submit papers for the 20th Annual Waterborne, Higher-Solids, and Powder Coatings Symposium, on February 24-26, 1993, in New Orleans, LA. The symposium is cosponsored by the Southern Society for Coatings Technology and the Department of Polymer Science at the University of Southern Mississippi (USM).

Papers related to the chemistry, formulation, and marketing of waterborne, higher-solids, powder, and other advanced coating systems are welcome. Papers related to engineering aspects of coating systems or solvent abatement also are solicited.

Title, abstract, and author's names (speaker's name underlined) should be submitted by August 14 to Dr. Robson F. Storey or Dr. Shelby F. Thames, Dept. of Polymer Science, USM, Southern Station Box 10076, Hattiesburg, MS 39406-0076.

Completed manuscripts should be submitted by November 30. A preliminary program will be developed based on the submitted abstracts. Papers will be required for inclusion in the Symposium *Proceedings*.

It is a requirement that all papers be original and of scientific value.

For additional information, contact Drs. Storey or Thames at (601) 266-5193, -4879, -5618.

Adhesion Society of Japan to Sponsor International Symposium November 6-10, 1994, in Celebration of 30th Anniversary

The Adhesion Society of Japan will celebrate its 30th anniversary by sponsoring the International Adhesion Symposium on November 6-10, 1994, in Pacifico Yokohama, Japan.

All prospective authors are invited to submit papers for presentation. Manuscripts on all aspects of adhesion science and technology are invited. Topics which will be emphasized in the technical sessions include: surface and interface, rheology and mechanics, functional adhesives, pressure sensitive adhesives technology, adhesives for biomedical uses, environmental problems—recycling and pollution, and general areas of interest—analytical methods, equipment, applications, durability, etc.

Papers may be presented in either the oral or poster sessions. Full length manuscripts are required for papers in the oral session for inclusion in the *Proceedings*, and publication in a special issue of the *Journal of the Adhesion Society of Japan*. Authors making presentations in the poster session are required to prepare manuscripts of a least three to four pages.

Tentative deadlines are as follows: a title and a short abstract of prospective papers are due no later than November 1, 1993; and completed manuscripts should be submitted no later than August 1, 1994.

For more details, contact Symposium General Chairman Dr. Hiroshi Mizumachi, Professor, Chemistry of Polymeric Materials, The University of Tokyo, Yayoi 1-1-1, Bunkyo-ko, Tokyo 113, Japan.

Estimating for Painting Contractors Short Course Cosponsored by UMR and The Glidden Company

The University of Missouri-Rolla (UMR) Coatings Institute, Rolla, MO, and The Glidden Company, Cleveland, OH, are cosponsoring the course, "Estimating for Painting Contractors and Maintenance Engineers," at various locations in the U.S.

The course is designed for painting contractors, painting crew supervisors, architects, and maintenance engineers. The class will feature blueprint reading, specifications including CSI format, quality take off, pricing structure, and an exercise in estimating by the participants including putting together a formal bid in class.

Instructor for the short course is Len Hijuelos, an independent Consultant.

The workshop is slated for the following dates and locations: July 13-15—Sheraton Perimeter, Birmingham, AL; July 29-31—Sheraton Airport Plaza, Charlotte, NC; and August 3-5—Sheraton Plaza-Mall, Orlando, FL.

For more information, contact Dr. Michael Van De Mark or Tamie D. Look, UMR, Dept. of Chemistry, 142 Schrenk Hall, Rolla, MO 65401-0249.

Literature

ICP Standards

The addition of single element plasma emission (ICP) standards to a company's product line has been announced through a product release. These standards were created to meet the demand for water and solid waste analysis as detailed in EPA Methods SW-946 and 200 Series. Contact Judy Corona, Product Manager/Standards and Solutions, EM Science, P.O. Box 70, 480 Democrat Rd., Gibbstown, NJ 08027 for further information on the new ICP Standards.

Solid Peroxygen

A four-page data sheet detailing a time-release solid peroxygen for environmental treatment applications has been printed. The peroxygen reportedly dechlorinates wastewater, deodorizes sludges and wastewater, thickens and conditions sludges, and enhances bioremediation of soil. Copies of the PermeOx™ Solid Peroxygen technical data sheet are available from FMC Corp., Peroxygen Chemicals Div., Attn: Commercial Development, 1735 Market St., Philadelphia, PA 19103.

Pipeline Coating

A technical data sheet announcing the availability of a two-component polyurethane for use in lining both steel and concrete pipe has been released. The literature summarizes the product and its uses, technical information, application instructions, and health and safety. For further information on CORROPIPE II PW, contact Madison Chemical Industries Inc., 5673 Old Dixie Rd., Ste. 160, Forest Park, GA 30050.

Silicon Carbide

A technical data sheet introducing a megnetron sputterable silicon carbide has been issued. The literature includes applications and physical properties such as control of index of refraction, transmission versus optical wavelength, film and film composition, optical band gag, and dielectric properties which have been analyzed as a function of hydrogen and argon partial pressures. To obtain copies of the data sheet A-12065 on Hexoloy® SG SiC sputtering targets, contact Structural Ceramics Div., The Carborundum Co., P.O. Box 1054, Niagara Falls, NY 14302.

Lead-Based Paint Engineering Services

A two-color, two-page brochure outlining lead paint removal engineering services has been released. Services highlighted include: study and report phase; preliminary design phase; final design phase; bidding and negotiation phase; construction phase; post-construction phase; and project management. For more in-depth details and a copy of the brochure, write KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275.

Pressure Transducers

A complete line of high-performance transducers for pressure measurement in plastic melt and general industrial applications is described and illustrated in an eight-page brochure. Included in the literature are features and specifications of various transducer models and configurations in ranges from 0 to 150 and 0 to 30,000 psi. For further details, write Gefran Inc., 122 Terry Dr., Newtown, PA 18940.

Prime Coat

A new four-color brochure describing a prime coat for drywall has been printed. The coat can reportedly be applied easily and dries to a white finish in less than 30 minutes. For a copy of the "SHEETROCK First Coat" brochure, write United States Gypsum Co., 101 S. Wacker Dr., Chicago, IL 60606.

Metering Pumps

An 8 1/2 x 11 inch selection guide for metering pumps is now available. The chart classifies four different types of pumps: electronic, mechanical, hydraulic (lost motion), and hydraulic (non-lost motion). For a free copy of the "Proportioneer Pump Selection Guide," contact Olivia Ehmer, Proportioneer Pumps, 150 Elmgrove Park, Rochester, NY 14624.

Paint Monitor

A new paint monitor and sampling kits are the topic of a technical brief. The paint monitor and kits are designed to be used to determine particulate and fiber contamination levels in solvent and aqueous based coatings. To request a copy of the brief (literature number PF019), write Millipore Corp., 80 Ashby Rd., Bedford, MA 01730.

Heat Exchangers

Heat exchangers for corrosive and high-pressure/high-temperature applications are highlighted in a 32-page bulletin. The publication discusses the tube seal and tube sheet designs found in the shell and tube heat exchangers. For a free copy of the brochure, "Corning Heat Exchangers," contact William Jackson, Corning Inc., Corning Process Systems, Big Flats Plant, Big Flats, NY 14814.

Haze Calculation

Literature has been released on a haze index calculation feature which can be added to existing software for a color quality control system. The feature is designed for the measurement of haze in plastic packaging films and other applications where the correct appearance of transparent or translucent materials is important. Further information can be obtained by contacting Macbeth, P.O. Box 230, Newburgh, NY 12551-0230.

SITUATIONS WANTED

I am an Industrial Chemist with 20 years of experience which includes coil coating, technical service, and management and have a solid background in formulation with alkyd, epoxy, vinyl, and urethane. I am a Canadian citizen with a U.S. Green Card and seek an opportunity to move to the United States. Ajmal Mahmood, 1706 Woodside Lane, Pickering, Ontario L1V 4W3 Canada.

* * *

Paint Chemist with 15 plus years. R&D in Industrial Paints. Job experience includes product development, marketing service, and plant service. Ronald Koo, 2 Tamerlane Ct., Etobicoke, Ontario M9B 6G4 Canada.

* * *

Production Plant Manager seeking growth oriented company. Have more than 30 years of technical and managerial experience in the manufacture of paints and coatings. Served in positions from Production Manager in a union environment to Plant Manager exercising control of several foremen. Product understanding is excellent and experience has been both contractor oriented and consumer oriented. Problem solving a specialty. Carl Addington, 2442 Fiji Way, San Leandro, CA 94577.

Solvents

An eight-page brochure highlighting an expanded line of environmentally safe industrial cleaner and cleaner components has been issued. The full-color publication includes illustrations, descriptions, and performance comparisons for all of the company's solvents. Write Scott Gallagher, Glidco Organics, P.O. Box 389, Jacksonville, FL 32201, for a copy of the brochure on Glidsafe Solvents.

Catalog and Reference Guide

A 300-page catalog and reference guide for a company's line of products has been printed. The publication's contents include: 75 new GC chromatograms; a description of each GC column phase; GC and SPE manufacturers' cross-reference guides; SPE methods; and a complete line of accessories. To receive a free copy of the "1992 Catalog and Reference Guide," write J&W Scientific, 91 Blue Ravine Rd., Folsom, CA 95630.

Epoxy Ester Filler/Sealer

A product sheet has been released detailing a new epoxy ester masonry filler/sealer. The product is designed for use in new construction, or resurfacing spalled or deteriorating concrete walls and ceilings for a wide range of environments, including: car washes, power plants, tunnels, chemical plants, etc. Contact The Sherwin-Williams Co., c/o HKM Direct, 5501 Cass Ave., Cleveland, OH 44102, for further information on "Epoxy Ester Masonry Filler/Sealer (SWS-3686)."

Cleaning Machines

A line of automated, multiple-stage cleaning machines has been introduced through a product release. This pneumatically-powered cleaning equipment reportedly creates no hazardous fumes while operating. For more in-depth details on the Magnus NuMatic™ product line, write MacGill Chemical, 23000 St. Clair Ave., Cleveland, OH 44117.

Database

A personal computer database of thermochemical properties, physical properties, and phase diagrams is the subject of a product brochure. The database covers both organic and inorganic compounds and includes information on over 6,000 solids, 2,000 liquids, and 2,000 gases. Write ES Microware, 2234 Wade Ct., Hamilton, OH 45013, for more details on TAPP—A Thermochemical and Physical Property Database.

High Purity Alkylphenols

A four-page publication highlighting commercially available mono and dialkylphenol chemical products has been issued. The literature describes organic intermediates for the manufacture of surfactants, fragrances, plastic additives, resins, and other uses. For more technical details, contact Terry Jones, Marketing Manager, Chemical Div., Schenectady Chemicals, Inc., 797 Broadway, Schenectady, NY 12305.

FT-Raman Spectrometer

A new FT-Raman spectrometer is the subject of literature. The instrument includes a compact benchtop optics unit interfaced to an industry standard 386/486 PC. Write to FT-IR Div., Bruker Instruments, Inc., Manning Park, Billerica, MA 01821, for more specifics on the FT-Raman "stand alone" spectrometer.

Prepolymers

A new family of polyurethane prepolymers has been introduced through a data sheet. The prepolymers are designed to be used by polyurethane casters, coating formulators, and other users of polyurethane prepolymers. For additional information concerning ADIPRENE® LF products, write Uniroyal Chemical, Benson Rd., Middlebury, CT 06749.

Water Treatment Canister

A new water treatment canister for low flow treatment at industrial and commercial facilities or groundwater remediation sites is the topic of a product release. The canister includes a lined vessel, activated carbon, inlet connection, underdrain collector, and an outlet connection for treated effluent. For more technical details on FlowSorb™, write Calgon Carbon Corp., P.O. Box 717, Pittsburgh, PA 15230-0717.

Tubing Check Valves

Literature is now obtainable on a line of high-performance tubing check valves. These valves are designed specifically for tubing systems where exceptionally high quantities of thermoplastic valves are required. Contact Plast-O-Matic Valves, Inc., 430 Route 46, Totowa, NJ 07512, for further details on the PVDF (Kynar®) line of tubing check valves.

Acrylic Resins

A four-page, full-color brochure summarizing a company's range of acrylic resins has been printed. The bulletin lists the properties, applications, and markets of various specialty acrylic resins offered. Write George Roy, Rhône-Poulenc Inc., Specialty Resins Group, 9808 Bluegrass Pkwy., Louisville, KY 40299 for more information.

Solution to June's *"CrossLinks"*

Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422 (215) 940-0777, FAX: (215) 940-0292.

1992

(Sept. 14-15)—"Statistical Process Control and Its Application in the Coatings Industry" (SPC Level I). Sponsored by Professional Development Committee. Atlanta, GA.

(Sept. 16-18)—"Practical Application of Intermediate Statistics in a Total Quality Management System" (SPC Level II). Sponsored by Professional Development Committee. Atlanta, GA.

(Oct. 21-23)—70th Annual Meeting and 57th Paint Industries' Show. McCormick Place, Chicago, IL.

1993

(May 16-19)—Federation "Spring Week." Board of Directors Meeting on the 16th; Incoming Society Officers Meeting on the 17th; Spring Seminar on the 18th and 19th. South Shore Harbour Resort and Conference Center, League City (Houston), TX.

(Oct. 27-29)—71st Annual Meeting and 58th Paint Industries' Show. World Congress Center, Atlanta, GA.

1994

(May 12-15)—Federation "Spring Week." Spring Seminar on the 12th and 13th; Incoming Society Officers Meeting on the 14th; Board of Directors Meeting on the 15th. Marriott City Center Hotel, Minneapolis, MN.

(Oct. 12-14)—72nd Annual Meeting and 59th Paint Industries' Show. New Orleans Convention Center, New Orleans, LA.

SPECIAL SOCIETY MEETINGS

1993

(Mar. 23-25)—Golden Gate, Los Angeles, Pacific Northwest, and Rocky Mountain Societies. Western Coatings Societies' 21st Biennial Symposium and Show, Disneyland Hotel and Convention Center, Anaheim, CA.

(Feb. 24-26)—20th Annual Waterborne, Higher-Solids, and Powder Coatings Symposium. Cosponsored by the Southern Society for Coatings Technology and the University of Southern Mississippi (USM). New Orleans, LA. (Robson F. Storey or Shelby F. Thames, Dept. of Polymer Science, USM, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Apr. 21-23)—Southern Society Annual Meeting. Opryland Hotel, Nashville, TN. (Mary Finnigan, McCullough & Benton, Inc., 2900 G Carolina Center, Charlotte, NC 28208).

OTHER ORGANIZATIONS

1992

(July 13-15)—"Estimating for Painting Contractors and Maintenance Engineers." Short course sponsored by University of Missouri-Roll (UMR) and The Glidden Company. Sheraton Perimeter Hotel, Birmingham, AL. (Michael Van De Mark or Tamie D. Look, UMR, Dept. of Chemistry, 142 Schrenk Hall, Rolla, MO 65401-0249).

(July 13-17)—International Symposium on Surface Phenomena and Latexes in Water-Based Coatings and Printing Technology. Sponsored by Fine Particle Society. Riviera Hotel, Las Vegas, NV. (M.S. El-Aasser, Emulsion Polymers Institute, 111 Research Dr., Iacocca Hall, Lehigh University, Bethlehem, PA 18015).

(July 22-24)—"Basic Coatings for Sales and Marketing Personnel." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Airport Marriott Hotel, St. Louis, MO. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(July 29-31)—"Estimating for Painting Contractors and Maintenance Engineers." Short course sponsored by University of Missouri-Rolla (UMR) and The Glidden Company. Sheraton Airport Plaza, Charlotte, NC. (Michael Van De Mark or Tamie D. Look, UMR, Dept. of Chemistry, 142 Schrenk Hall, Rolla, MO 65401-0249).

(Aug. 3-5)—"Estimating for Painting Contractors and Maintenance Engineers." Short course sponsored by University of Missouri-Rolla (UMR) and The Glidden Company. Sheraton Plaza-Mall, Orlando, FL. (Michael Van De Mark or Tamie D. Look, UMR, Dept. of Chemistry, 142 Schrenk Hall, Rolla, MO 65401-0249).

(Aug. 3-7)—"Coatings Science for Coatings Technicians." Short course sponsored by University of Southern Mississippi (USM), Hattiesburg, MS. (Deborah A. Theisen, USM, Dept. of Polymer Science, Southern Station, P.O. Box 10076, Hattiesburg, MS 39406-0076).

(Aug. 10-14)—"Coatings Science for Coatings Chemists." Short course sponsored by University of Southern Mississippi (USM), Hattiesburg, MS. (Deborah A. Theisen, USM, Dept. of Polymer Science, Southern Station, P.O. Box 10076, Hattiesburg, MS 39406-0076).

(Aug. 16-21)—"Polymer Chemistry: Principles and Practice." Seminar sponsored by The American Chemical Society (ACS), Washington, D.C. Marriott Inn, Blacksburg, VA. (ACS, Dept. of Continuing Education, Meeting Code VPI9203, 1155 Sixteenth St., N.W., Washington, D.C. 20036).

(Aug. 17-21)—"Formulating Coatings." Short course sponsored by The University of Southern Mississippi (USM), Hattiesburg, MS. (Deborah Theisen, PSC Coatings Short Course, USM, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Sept. 7-11)—Corrosion Asia Conference. Cosponsored by the Japan Society of Corrosion Engineering, the Australasian Corrosion Association, the Chinese Society for Corrosion and Protection, the Malaysian Materials Society, the Materials and Corrosion Society of Thailand, and the Corrosion Engineering Association of the Republic of China. Hyatt Regency Hotel, Singapore. (National Association of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218-8340).

(Sept. 14-18)—65th Introductory Short Course, "The Basic Composition of Coatings." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Rolla Campus. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(Sept. 28-Oct. 2)—25th Introductory Short Course, "Paint Formulation." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Rolla Campus. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(Oct. 5-8)—"Introduction to Coatings Technology." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative & Continuing Education-Chemistry, KSU, P.O. Box 5109, Kent, OH 44242-0001).

(Oct. 6-8)—Powder Coating '92. Sponsored by the Powder Coating Institute (PCI). Cincinnati Convention Center, Cincinnati, OH. (Goyer Management International, 8072 Beechmont Ave., Cincinnati, OH 45255).

(Oct. 14-16)—"Accelerated and Natural Weathering Techniques for Coatings and Polymers." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative & Continuing Education-Chemistry, KSU, P.O. Box 5109, Kent, OH 44242-0001).

(Oct. 18-21)—Workshop on "Polymer Surfaces and Interfaces." Sponosored by the Division of Polymer Chemistry, Inc., American Chemical Society (ACS). Sheraton Tara Hotel & Resort, Danvers, MA. (Division of Polymer Chemistry, Inc., ACS, Diane M. Morrill, 1103 Hahn Hall, Virginia Tech, Blacksburg, VA 24061-0212).

(Oct. 19-21)—105th Annual Meeting of the National Paint and Coatings Association (NPCA). Palmer House, Chicago, IL. (NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Oct. 20-22)—"Emission Inventory Issues" Conference. Cosponsored by the Air & Waste Management Association and the U.S. Environmental Protection Agency. Omni Durham Hotel, Durham, NC. (Marci Mazzei, Air & Waste Management Association, P.O. Box 2861, Pittsburgh, PA 15230).

(Oct. 25-30)—Fourth Corrosion and Protection Iberoamerican Congress and First Panamerican Congress on Corrosion and Protection. Mar del Plata, Argentina. (CIDEPINT, 52 entre 121 y 122, 1900 La Plata, Argentina, South America).

(Oct. 27-28)—Polypropylene '92 World Congress. Sponsored by Maack Business Services. Swissôtel Zürich, Zürich, Switzerland. (Maack Business Services, Plastics Technology and Marketing, Moosacherstrasse 14, CH-8804 Au/Zh, Switzerland).

(Nov. 4-6)—'92 International Conference on Colour Materials. Sponsored by the Japan Society of Colour Material. Osaka Sun Palace, Expo Park Senri, Osaka, Japan. (S. Tochihara, Chairman of Executive Committee of the '92 ICCM, c/o Japan Society of Colour Material, Kitamura Bldg. 5F, 9-12, 2-chome, Iwamoto-cho, Chiyoda-ku, Tokyo 101, Japan).

(Nov. 8-12)—Annual Conference 32. Sponsored by the Australasian Corrosion Association Inc., Hobart, Tasmania. (Conference Secretariat, Australasian Corrosion Centre, P.O. Box 250, Clayton, Victoria 3168, Australia).

(Nov. 14-20)—SSPC '92 National Conference and Exhibition. Sponsored by Steel Structures Painting Council (SSPC), Pittsburgh, PA. Kansas City Convention Center, Kansas City, MO. (Rose Mary Surgent, Manager of Conferences and Exhibits, SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213-2683).

(Nov. 16-20)—"Fundamentals of Chromatographic Analysis." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative & Continuing Education-Chemistry, KSU, P.O. Box 5109, Kent, OH 44242-0001).

(Nov. 18-19)—Resins & Pigments '92. Sponsored by *Polymers Paint Colour Journal* and *Paint & Ink International*. Fiera Milano, Hall 20, Milano, Italy. (Jane Malcolm-Coe, PR & Publicity Mgr., FMJ International Publications Ltd., Queensway House, 2 Queensway, Redhill, Surrey, RH1 1QS, United Kingdom).

(Dec. 6-11)—"Polymer Chemistry: Principles and Practice." Seminar sponsored by The American Chemical Society (ACS), Washington, D.C. Marriott Inn, Blacksburg, VA. (ACS, Dept. of Continuing Education, Meeting Code VPI9203, 1155 Sixteenth St., N.W., Washington, D.C. 20036).

(Dec. 7-9)—SP '92 World Congress. Sponsored by Maack Business Services. Swissôtel Zürich, Zürich, Switzerland. (Maack Business Services, Plastics Technology and Marketing, Moosacherstrasse 14, CH-8804, Au/Zh, Switzerland).

1993

(Jan. 19-20)—"Accelerated and Outdoor Durability Testing." Symposium sponsored by ASTM Committee G-3 and Subcommittee D01.27. Ft. Lauderdale, FL. (Warren D. Ketola, 3M Co., Bldg. 553-A, 3M Center, St. Paul, MN 55144, or Douglas Grossman, The Q-Panel Co., 26200 First St., Cleveland, OH 44145).

(Jan. 20-22)—Pretreat '93 Conference. Sponsored by *Products Finishing*. Orlando Marriott, Orlando, FL. (Cindy Goodridge, Gardner Management Services, 6600 Clough Pike, Cincinnati, OH 45244).

(Feb. 21-26)—16th Annual Meeting of The Adhesion Society, Inc. Williamsburg Lodge, Colonial Williamsburg, VA. (Louis H. Sharpe, 28 Red Maple Rd., Hilton Head Island, SC 29928, or F.J. Boerio, Dept. of Materials Science and Engineering {ML 12}, University of Cincinnati, Cincinnati, OH 45221).

(Mar. 23-25)—International Symposium on Advanced Infrared Spectroscopy (AIRS). Sponsored by The Spectroscopic Society of Japan. Sanjo Conference Hall, The University of Tokyo, Tokyo, Japan. (Hirokazu Toriumi, AIRS Organizing Committee, Dept. of Chemistry, College of Arts and Sciences, The University of Tokyo, Komaba, Meguro, Tokyo 153, Japan).

(Apr. 13-15)—Surface Coating '93 Exhibition. Sponsored by Chemical Coaters Association International (CCAI). Grand Center Convention Facility and Amway Grand Hotel, Grand Rapids, MI. (CCAI, P.O. Box 54316, Cincinnati, OH 45254).

(Apr. 18-23)—"Durability of Coatings" Symposium sponsored by American Chemical Society, Division of Polymeric Materials: Science Engineering, Denver, CO. (Jonathan W. Martin, NIST, Bldg. 226, Rm. B348, Gaithersburg, MD 20879; David Bauer, Ford Motor Co., SRL-E3198, P.O. Box 2053, Dearborn, MI 48121; F. Louis Floyd, Glidden Research Ctr., 16651 Sprague Rd., Strongsville, OH 44136).

(Apr. 20-22)—Surface Treatment '93. "Computer Methods and Experimental Measurements for Surface Treatment Effects." International Conference sponsored by Wessex Institute of Technology. Novotel, Southampton, United Kingdom. (Sue Owen, Conference Secretariat, Wessex Institute of Technology, Ashurst, Southampton, Hants, United Kingdom So4 2AA).

(May 2-6)—RadTech Europe '93. Third Annual RadTech conference. Sponsored by RadTech Europe. Italian vessel T/S Eugenio Costa. (RadTech Europe, Business Office, Pérolles 24, CH-1700 Fribourg, Switzerland).

(May 4-6)—Hazardous Materials and Environmental Management Conference and Exhibition (HazMat West/Spring). Sponsored by Tower Conference Management Company. Long Beach Convention Center, Long Beach, CA. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E—Ste. 408, Glen Ellyn, IL 60137-5835).

Advertisers Index

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'Humbug' from Hillman

A letter from Larry Hill, the talented and longtime Editor of *Surface Coatings, Australia*, contained some of the nonsense that you will find below and also suggested as follows, "You might like to challenge your readers to produce the most atrocious puns possible. To get them started, I offer the following."

Now, although I secretly rub my hands and grin with fiendish glee in pleased anticipation of the suffering about to be imposed on our readers, I am too much of a coward to propose such a challenge. I am fearful of thrusting myself into a "Salman Rushdie" situation. After all, everyone knows where I live, while Larry is safely situated in the Australian outback. So remember dear readers, you have LARRY HILL to blame for the inspiration that prompted this column. As Bob Ahlf is wont to note—"The buck stops way over there!" And now for Larry's offering:

—Joe Inuitt, an Eskimo, was out fishing. His feet became very cold. So, to warm them up, he lit a fire at the front of his kayak. Unfortunately, the fire got out of control and destroyed his kayak, forcing him to swim to shore. This proves, "YOU CAN'T HAVE YOUR KAYAK AND HEAT IT TOO!"

—The Spanish Civil War was at its height and a group of Basques were attacked in a canyon with three possible escape routes. They all retreated through one defile, unluckily the wrong one. They were all killed. This proves, "YOU SHOULDN'T PUT ALL YOUR BASQUES IN ONE EXIT!"

—Laughing Water, the old Sioux, had three wives. One slept on an elk hide. One slept on a moose hide and one, of African origin, slept on a hippo hide. In due course, all three wives gave birth. The wife who slept on the elk hide bore a lovely son. The wife who slept on the moose hide bore a beautiful daughter. The wife who slept on the hippo hide bore handsome twins, a boy and a girl. Which proves the proposition: "THE SQUAW ON THE HIPPOPOTAMUS IS EQUAL TO THE SUM OF THE SQUAWS ON THE OTHER TWO HIDES."

Bob Johnson, our friend and postmaster, will have to take responsibility for this: A South Sea Island chieftain, in keeping with his high office, lived in a magnificent grass hut that contained his old throne of office. He demanded a new and more ornate one. His subjects granted his wish and presented him with a stunning throne. He directed that the old one be stowed away in the attic.

One day after the new throne was installed and the old one stowed away, a terrible storm shook his grass mansion. The old throne shook loose and fell on the king's head, killing him. This teaches us: "PEOPLE WHO LIVE IN GRASS HOUSES SHOULDN'T STOW THRONES."

I promised the person who gave me *Crosbie's Book of Punned Haiku* that I would never reveal the donor. "Haiku" appears to be Japanese for poems of seventeen syllables and just three lines. The author threw in the added complication of rhyming the first and third line which he saw as either a breakthrough or breakdown in English literature.

Though she loved the male,
She made it clear to sailors
She was not for sail.

For a holy stint,
A moth of the cloth gave up
His woolens for lint.

Do owls on a toot
Get so carried away they
Don't give a hoot?

Each night until dawn
The stags all play. How time flies
When your having fawn!

In our youthful slacks
Thoughts of love made us tense. Now
Old,—lotus relax.

Vermont's favorite:

If the spring bird cries
Before the last snow melts, you're in
For a big sap rise.

—John S. Crosbie, 1979, Workman Publishing Co.

Our kindly and final f(r)iend to be honored this day is John Warner who has donated his copy of *The Little Pun Book* to punish us all:

—One day two old ladies went for a tramp in the woods but he got away.

—One black bird said to another, "Bred any good rooks lately?"

—A good masseur leaves no stern untoned.

—As ass can never be a horse, but he can be a mayor.

—When a customer demanded an out-of-print cookbook, the bookstore manager replied, "Madam, we cannot have archaic and eat it too."

—When a group of miniature cattle were put in the Sputnik, it became the herd shot round the world.

—Two German lads were proceeding gingerly along a narrow mountain ledge with their mother. Below them was a drop of a thousand feet. One of the boys suddenly realized that their mother had disappeared. He called back to his brother, saying, "Look Hans, no Ma!"

—A Greek demolition firm is called Edifice Wrecks.

—Beautiful Spanish senoritas are a snare Andalusian.

—Mama Broom told Papa Broom, "We're going to have a little Whisk Broom." Papa replied, "How is that possible? We haven't even swept together."

—A man moved to Kansas City with the firm belief that Missouri loves company.

—*The Little Pun Book*, 1960, Peter Pauper Press

—Herb Hillman
Humbug's Nest
P.O. Box 135
Whitingham, VT 05361

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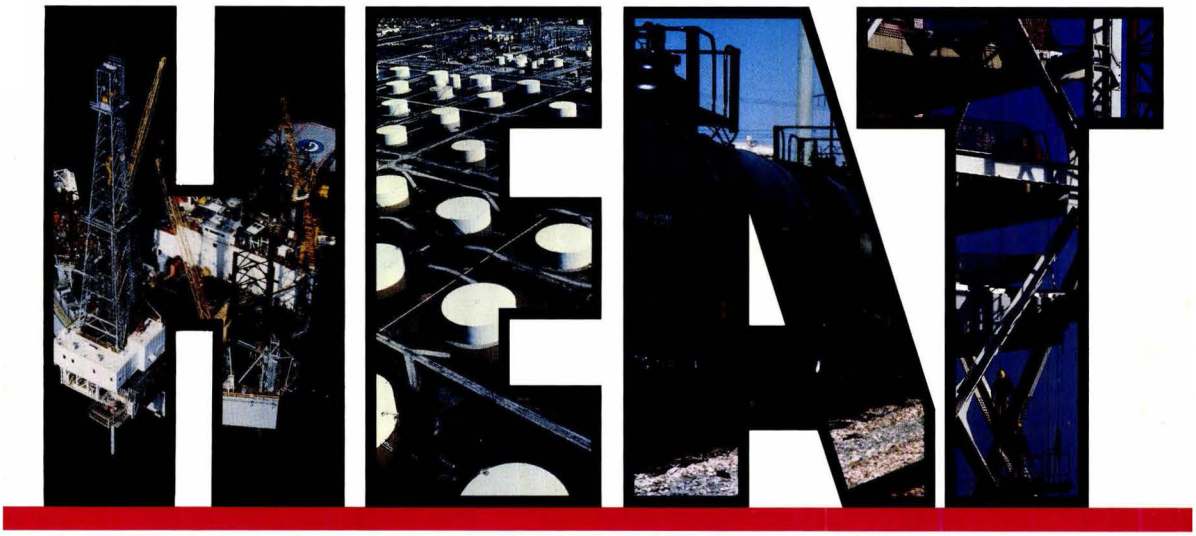

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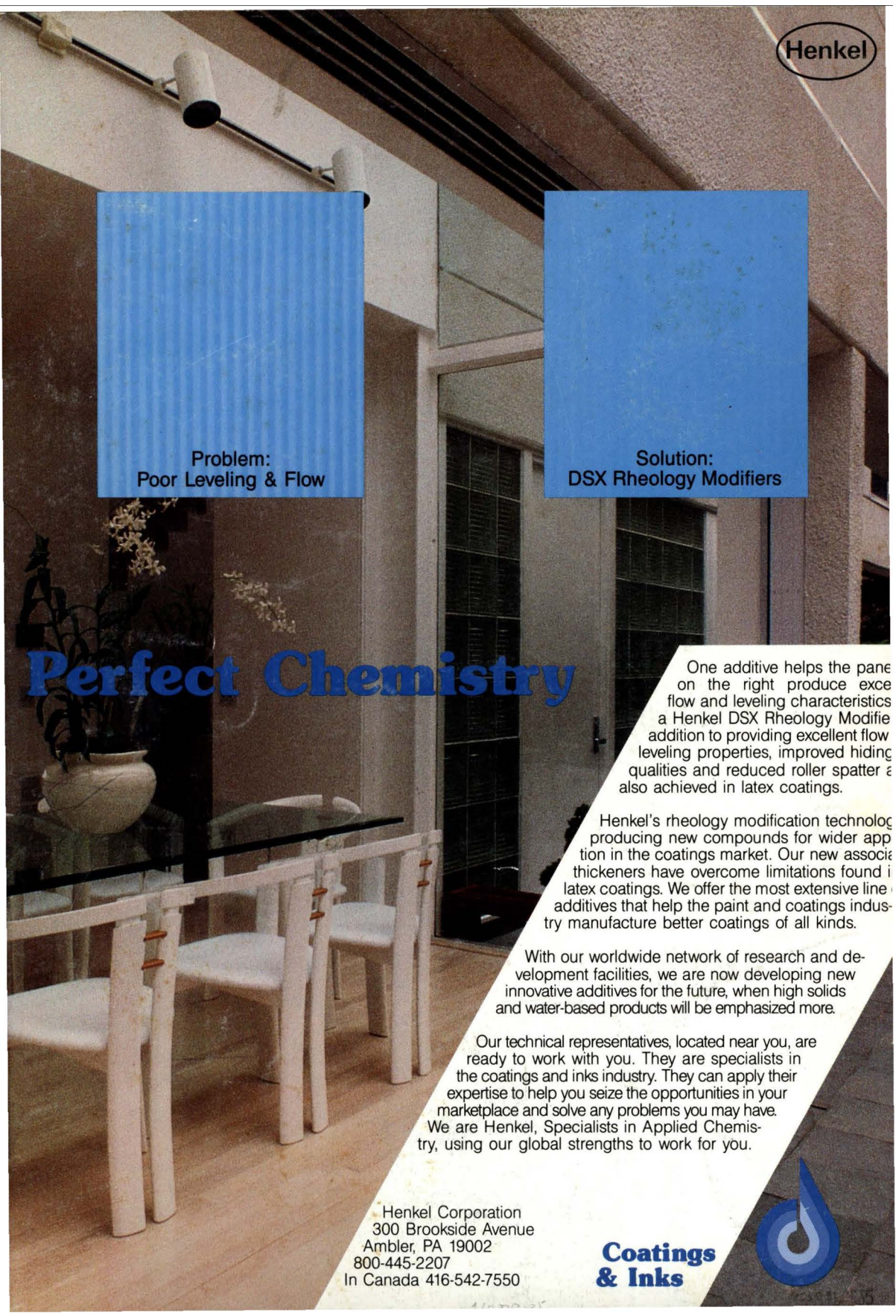
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