*Use of a
Mathematical Model
to Predict the Effects
of Extenders on
Pigment Dispersion
in Paint Films*

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Comment

May We Serve You?

While the nation may be rebounding slowly from the past several years of economic malaise, the Federation is going forward with a continuing array of programs and services for its membership and the industry.
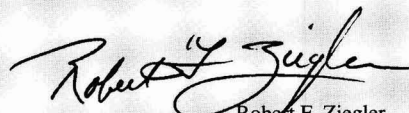
The decline and slow recovery of many industries is being felt not only in the business sense but also at a more personal level. Members who at one time thought that a stable, slow growth industry, such as the coatings industry, provided for some measure of stability, have found that in troubled times no one is immune to cutbacks. Recently, the FSCT addressed the situation and has offered access to the pages of this journal in an attempt to match talented, available members with open positions. Members who are unemployed can contact the FSCT's advertising services department for more details.

This month the Federation features a can't miss opportunity to learn more about TQM and securing an ISO 9000 Series certification during a series of two seminars in Philadelphia. In September, the series continues with both level one and level two courses in statistical process control, to be held in Atlanta.

Publications continue to play a major role in the technical education of the membership. Recently, the 19th booklet ("Powder Coatings") of the *Federation Series on Coatings Technology* was published. Authored by industry's technical leaders, these inexpensive booklets offer an up-to-date look at the many aspects of coatings technology. The newly revised *IR Spectroscopy Atlas* provides a library of over 2,500 spectra of raw materials and is available in both hardcover and software formats. And, in matters of the printed word, the monthly JCT offers the best in technical literature.

In October, members can look forward to attending the Federation's largest Annual Meeting and Paint Industries' Show. With almost 60 technical papers scheduled, over 270 exhibitors on-hand, and an anticipated 8,000 industry personnel attending, the events present both an opportunity and a challenge . . . the opportunity to receive the vital information needed in today's competitive climate, and the challenge to cover as much as possible over the two-and-one-half days of the convention.

Meanwhile, the Federation, its officers, committees, and staff reaffirm their commitment to serving the industry and its membership. We encourage comments and suggestions. For although the economy is travelling at a snail's pace, our members expect and deserve more.

Robert F. Ziegler
Executive Vice President

Abstracts of Papers in This Issue

Use of a Mathematical Model to Predict the Effects of Extenders on Pigment Dispersion in Paint Films—J. Temperley et al.

Journal of Coatings Technology, 64, No. 809, 33 (June 1992)

A mathematical model to predict the packing of particles in pigmented films has been developed. A Monte Carlo method is used to generate random positions in a box for spheres with a specified size distribution and desired volume concentration. The nearest neighbor distribution gives an indication of dispersion.

The results, for spheres clustered according to a Smoluchowski distribution, compare well with electron micrographs of pigmented films. This model has been used to study the effect of pigment crystal and particle size on dispersion. The results highlight the spacing advantages of a larger crystal size.

This approach has also been used to predict the effect of extender particles on pigment dispersion. The model suggests that small particle size extenders (ca 0.1 µm) should improve pigment spacing and, therefore, scattering efficiency. However, for larger extenders (at a fixed pigment loading), as extender volume concentration is raised, pigment spacing decreases. Results from the model suggest that an increase in the width of the extender size distribution can improve pigment dispersion.

The Effect of Plasma Treatment of Titanium Dixoide and Quinacridone Red Pigments on Dispersion Behavior in Water-Soluble Acrylic Resins—T. Kobayashi et al.

Journal of Coatings Technology, 64, No. 809, 41 (June 1992)

Surface modification of quinacridone red and TiO$_2$ pigments was carried out using a low temperature plasma method. Quinacridone red was treated with NH$_3$ plasma, and TiO$_2$ was treated with styrene and octafluorocycrobutane plasmas.

The dispersion behavior of such plasma treated pigments in water-soluble acrylic resins was studied and correlated to the hydrophilicity (hydrophile property) of the pigments. The degree of hydrophilicity was evaluated by measuring the heat of immersion in water.

It was found that the most favorable hydrophilicity values for the pigment dispersion in water-soluble acrylic resin was around 0.25 J/m^2 by the heat of immersion in water.

Utilisation D'un Modèle Mathématique Pour Prédire les Effets Des Matières de Charge Sur la Dispersion Pigmentaire Dans les Feuils de Peinture—J. Temperley et al.

Journal of Coatings Technology, 64, No. 809, 33 (June 1992)

Un modèle mathématique a été développé afin de prédire le tassement des particules dans un feuil pigmenté. Une méthode de type Monte-Carlo est utilisée pour produire des positions aléatoires dans un cube, pour des sphères ayant une certaine distribution en taille ainsi qu'une concentration volumique donnée. La proximité des voisins donne ainsi une indication de la dispersion.

Les résultats obtenus avec des sphères distribuées selon une distribution de type Smoluchowski se comparent bien avec des photographies prises par microscopie électronique de divers feuils pigmentés. Le modèle a été utilisé pour étudier l'effet du type et de la grosseur du cristal sur la dispersion pigmentaire. Les résultats mettent bien en évidence les avantages de l'utilisation d'un cristal de forte taille.

Cette méthodologie a également été utilisée pour prédire l'effet des matières de charge sur la dispersion pigmentaire. Le modèle suggère que l'utilisation de matières de charge de petites tailles (0.1 µm) devrait augmenter l'espacement des pigments, et ainsi améliorer l'efficacité de diffusion des pigments. Par contre, pour des matières de charge de plus grandes tailles (à une concentration pigmentaire fixe), l'espacement des pigments décroît avec la concentration volumique des matières de charge. Les résultats obtenus avec l'aide du modèle suggèrent qu'une augmentation de la distribution en taille des matières de charge peut améliorer la dispersion pigmentaire.

L'ffet d'un Traitement Au Plasma de Pigments de bioxyde de Titane et de Rouge de Quinacridone Sur la Dispersion Dans des Résines Acryliques Solubles À L'eau—T. Kobayashi et al.

Journal of Coatings Technology, 64, No. 809, 41 (June 1992)

La modification de la surface de pigments de bioxyde de titane et de rouge de quinacridone a été effectuée à l'aide d'une technique au plasma à basse température. La rouge de quinacridone a été traité avec un plasma à base d'ammoniac, tandis que le bioxyde de titane a été traité avec des plasmas à base de styrène et d'octafluorocycrobutane.

Uso de un Modelo Matematico Para Predecir los Efectos de los Extensores en Dispersiones de Pigmentos en Peliculas de Pintura—J. Temperley et al.

Journal of Coatings Technology, 64, No. 809, 33 (June 1992)

Se desarrolló un modelo matemático para predecir el empaquetamiento de las partículas en películas de pintura. Se utilizó el Método de Monte Carlo para generar las posiciones aleatorias en una caja de esferas con una distribución de tamaño específica y la concentración de volumen deseada. La distribución vecina más cercana proporciona una indicación de la dispersión.

Los resultados, para esferas agrupadas de acuerdo con la distribución de Smoluchowski, se comparan muy bien con los microgramas del electrón en películas pigmentadas. Este modelo se ha usado para estudiar el efecto del cristal del pigmento y el tamaño de partícula en la dispersión. Los resultados depurados muestran las ventajas de espacio de un cristal de tamaño grande.

Este concepto también se ha utilizado para predecir el efecto de las particulas del extensor en la dispersión del pigmento. El modelo sugiere que tamaños de partícula pequeños de extensor (pe 0.1 µm) pueden proporcionar un espacio entre el pigmento y, aún más, una mejoría en la eficiencia de la dispersión. Sin embargo, para extensores de gran tamaño (en una carga fija de pigmento), como la concentración en volumen del extensor crece, el espacio entre el pigmento decrese. Los resultados del modelo sugieren que un incremente en el ancho de la distribución de tamaño del extensor puede mejorar la dispersión del pigmento.

Efecto del Tratamiento de Plasma de Dioxido de Titanio y Pigmentos Rojo Quinacridona en el Comportamiento de la Dispersion en Resinas Acrilicas Solubles en Agua—T. Kobayashi et al.

Journal of Coatings Technology, 64, No. 809, 41 (June 1992)

Se llevaron a cabo modificaciones de superficie de rojo quinacridona y TiO$_2$ mediante el Método de Plasma a baja temperatura. El rojo quinacridona se trató con una plasma de NH$_3$, y el TiO$_2$ se trató con plasmas de estireno y octafluorocicrobutano.

Se estudio el comportamiento de dispersión de los pigmentos tratados con cada uno de los plasmas en resinas acrílicas solubles en agua y se correlacionó con la

High Solids Polyorganosiloxane Polymers for High Temperature Applications—W.A. Finzel

Polyorganosiloxane (silicone) resins have historically been available for high temperature applications at relatively low nonvolatile content. Since no one silicone resin is available that fulfills all customer performance properties, a family of resins have been developed that by themselves or blended with other silicone or organic resins can best meet customer needs. Unique processing techniques and cure chemistry have resulted in higher nonvolatile content silicone resins that achieve desired film performance. Three silicone resins will be described that represent soft, medium hard, and hard resins all with low volatile compound (VOC) content. The paper will describe solution and paint film properties of the higher nonvolatile content resins and compare these properties with conventional silicone resins.

Coatings Based on Polymer/Polymer Composites—V.V. Verkholantsev

The term polymer/polymer composites (PPC) applies to heterophase polymer blends, obtained in the process of synthesis, by mixing polymers in bulk, solution or dispersion, or by phase decomposition of initially homophase polymer blends. Homophase solutions of two or more incompatible polymers can be obtained using the common solvent—frequently two or multicomponent mixtures of organic solvents. Under a certain condition, and particularly during the solvent evaporation and curing process, these systems form the heterophase, nonhomogeneous in-layer or double-layer coatings. From solutions of solid epoxy + perchlorvinyl resin, epoxy + polysiloxane and from other partly compatible polymer blends, which are enable to phase separation and sometimes to self-stratifying during film forming process, the new type of solvent-based anticorrosive and weather resistant enamels were introduced into the market as one coat top/primers.

These epoxy-based enamels were ambient cure (two component), applied to conventionally prepared metal surface by one step regular or airless spraying. Recommended dry film thickness 60-200 μm. In relation to protective functions and service life, these one-coat materials are adequate to the multilayer conventional coatings, based on the same film formers.

Toward a Unified Strategy of Service Life Prediction—R.A. Dickie

The prediction of coating service life is one of the toughest problems that face the coat-

La dispersion de ces pigments traités au plasma dans des résines acryliques solubles à l'eau a été étudiée et corrélée au caractère hydrophile des pigments.

Les résultats obtenus démontrent que les valeurs du caractère hydrophile des pigments dispersés dans des résines acryliques solubles à l'eau étaient de 0.25 J/m² tel que déterminé par la chaleur d'immersion dans l'eau.

Polymères Polyorganosiloxane À Hautes Teneurs en Matières Solides Pour des Applications Exigeant de Hautes Températures—W.A. Finzel

Les résines polyorganosiloxanes (silicones) sont depuis longtemps disponibles pour des applications exigeant de hautes températures, mais seulement à de faibles teneurs en matières solides. Puisqu'aucune résines de silicone disponibles ne peuvent remplir toutes les propriétés recherchées, une famille de résines a été développée afin de remplir certaines lacunes. Des techniques particulières ont permis la production de résines de silicone possédant de hautes teneurs en matières solides, et possédant des propriétés recherchées. Trois types de résines de silicone sont décrites, possédant toutes de bas contenus en matières organiques volatiles (cov). Cette publication décrit les propriétés des feuils de peinture contenant les résines à hautes teneurs en matières solides et compare ces propriétés avec des résines de silicone conventionnelles.

Revetements a Base de Composites Polymere/Polymere—V.V. Verkholantsev

Le terme composite polymère/polymère s'applique aux mélanges polymériques en phase mixte, obtenus par un procédé de synthèse, par mélange de polymères en vrac, en solution ou en dispersion, ou par la décomposition en phase de mélanges polymériques initialement homophasiques. Des solutions homophasiques de plus de deux polymères incompatibles peuvent être obtenus par l'utilisation de solvants, fréquemment des mélanges binaires de solvants organiques. Sous une condition bien particulière, durant l'évaporation du solvant et le durcissement, ces systèmes forment la phase hétéro non-homogène, en simple ou en double couche. A base de solutions d'époxy solide et de résine perchlorovinylique, époxy + polysiloxane et d'autres mélanges polymériques compatibles, qui sont capables de séparation de phase et quelque fois à à de l'autostratification durant la formation du feuil, les nouveaux types d'émaux anticorrosifs ont été implantés comme apprêts monocouches.

hidrofilicidad (propiedad hidrófila) de los pigmentos. El grado de hidrofilicidad se evaluó midiendo el calor de inmersión en agua.

Se encontró que los valores de hidrofilicidad más favorables para la dispersión de pigmento en la resina acrílica soluble en agua se encuentra en 0.25 J/m² para el calor de inmersión en agua.

Polimeros Poliorganosiloxano de Altos Solidos Para Aplicaciones de Atlas Temperaturas—W.A. Finzel

Las resinas poliorganosiloxano (silicon) se encuentran disponibles historicamente para aplicaciones a altas temperaturas a un contenido relativamente muy bajo de no volatiles. A raiz de que no existe disponible una resina de silicon que cumpla con todas las requisiciones de propiedades del consumidor, se ha desarrollado una familia de resinas que por si solas o en mezclas con otros silicones o algunas resinas orgánicas pueden cumpliar con las necesidades del cliente. Las técnicas unicas de procesamiento y de curado química han resultado en una serie de resinas de silicon con un contenido más alto de no volátiles que pueden proporcionar los reugerimientos de calidad deseados. Se describen tres series de resinas que representan las suaves, medias y duras todas con bajo contenido de volátiles (VOC). El artículo describe las propiedades de la película de pintura con las resinas de alto contenido de no-volátiles y compara estas con las propiedades de las resinas de silicon convencionales.

Recubrimientos Basados en Compuestos Polimero/Polimero— V.V. Verkholantsev

El término de compuesto polímero/polímero (PPC) aplica a mezclas de polímeros con una heterofase, obtenidos en el proceso de síntesis, mediante la mezcla de polimeros en bloque, solución o dispersión, o por una descomposición de la fase inicalmente en la homofase de la mezcla polimérica. Se puede obtener una homofase en solución de dos o más polímeros incompatibles utilizando una solvente común - frecuentemente una mezcla de dos o más solventes orgánicos. Bajo ciertas condiciones y particularmente en la evaporación del solvente en procesos de curado estos sistemas forman la heterofase, sobre todo en capas no-homogeneas o recubrimientos de doble capa. De soluciones de epóxica sólida + resina de perclorovinil, epóxico + polisiloxano y de otras mezclas poliméricas parcialmente compatibles, las cuales son susceptibles de presentar una separación de fases y en algunas ocasiones una auto-estratificación durante el proceso de formación de la

ings chemist. In this paper, a general framework connecting laboratory experiments, field exposure history, and theoretical and empirical models is suggested. The central role of physical and chemical models of degradation processes in service life prediction is highlighted.

Ces émaux époxydiques ont durcis à la température ambiante (2 composés), appliqués sur une surface métallique par une étape de pulvérisation sans air. L'épaisseur recommandée du film est de 60-200 microns. Les propriétés de protection des ces matériaux monocouches sont adéquats par rapport aux revêtements multicouches à base des mêmes polymères.

Proposition D'une Stratégie Unifiée Pour Predire la Durée de Vie D'un Revêtement—R.A. Dickie

La prédiction de la durée de vie d'un revêtement est sans nul doute un des plus grands problèmes auquel doivent faire face les chimistes oeuvrant dans le domaine. Cette publication propose un ensemble reliant les résultats de laboratoires, l'historique de l'exposition aux intempéries ainsi que les modèles empiriques et théoriques. Le rôle clé des modèles physico-chimiques des procédés de dégradation pour la prédiction de la durée de vie des revêtements est présenté.

pelicula, se introdujo el nuevo tipo de solvente con base de barnices anticorrosivos y de resistencia al intemperismo.

Estos barnices base epóxi también se curaron al medio ambiente (dos componentes), aplicados a una superficie metálica preparada convencionalmente mediante un sistema de aplicación común o un espreado por aire. El grosor recomendado para la pelicula seca es de 60-200 micrones. En relación con las funciones de protección y el tiempo de vida de servicio, este recubrimiento y los materiales que lo forman se adecuaron como un sistema de multicapas, basado en los mismos formadores de película.

En Busqueda de Una Estrategia Unificada Para Predecir la Vida de Servicio—R.A. Dickie

La predicción de la vida de servicio de un recubrimiento es uno de los problemas más difíciles con los cuales se enfrenta el químico en recubrimientos. En este artículo, se sugieren modelos empíricos y teóricos para una aplicación general en experimentos de laboratorio, y el historial de exposición en campo. Se sintetiza el papel central de los modelos físicos y quimicos dentro del proceso de degradación en la predicción de la vida de servicio.

Special Issue Schedule
JOURNAL OF COATINGS TECHNOLOGY

September '92—Pre-Paint Show Issue
The first official listing of the Preliminary Program of Technical Sessions is featured along with the floor plan of show exhibitors, registration forms, housing forms and hotel information, as well as general show information.

October '92—Paint Show Issue
This special Annual Meeting and Paint Show issue, which is distributed at the show in addition to our regular circulation, contains Abstracts of Papers to be presented; the final Program of Technical Sessions; floor plan of show exhibitors; an alphabetical list of exhibitors and their booth number; a list of exhibitors classified by product/service categories; and general show/meeting information.

January '93—Annual Meeting and Paint Show Wrap-up Issue
Featured is information on all exhibitors, with emphasis on exhibitor products and special booth features; photo displays of award-winning booths are presented; and a complete review of important Annual Meeting and Paint Show happenings is highlighted.

For more information, contact Lorraine Ledford,
JOURNAL OF COATINGS TECHNOLOGY,
492 Norristown Rd., Blue Bell, PA 19422
Phone: (215) 940-0777 • FAX: (215) 940-0292

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Jack Anderson to Present Keynote Address At FSCT Annual Meeting in Chicago, Oct. 21-23

The Federation of Societies for Coatings Technology is pleased to announce that noted columnist Jack Anderson will present the Keynote Address at Wednesday's Opening Session at the FSCT 70th Annual Meeting, in Chicago, IL, on October 21-23.

With his *Merry Go Round* column appearing in over 1000 newspapers daily, Mr. Anderson is the most widely syndicated columnist in the world. A regular contributor to *The Real Story,* CNBC's nightly live information-based show and a daily radio commentator for UPI Radio Network's 1100 stations, Mr. Anderson is also the best-selling author of numerous books (the most recent being *Stormin' Norman*).

Jack Anderson is considered a legend in journalistic circles. 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. It was from one of his numerous television documentaries that news of the recent terrorist attempts in the United States was revealed.

Public opinion has confirmed that Mr. Anderson's reports make a positive impact. When Ronald Reagan asked his private pollster, Richard Wirthlin, to determine the

Jack Anderson

nation's most trusted journalist, Jack Anderson was ranked first among the country's 254,000 journalists.

In addition to his reporting activites, he works with the Young Astronaut Program, which he developed to promote scientific study, encourage peace, and ensure a competitive America for future generations, as well as the Citizens Against Government Waste, which he designed, along with industrialist J. Peter Grace.

In past years, Mr. Anderson has hosted television's *American Expose*; *Jack Anderson: Confidential*; and FNN's *Insiders with Jack Anderson*. He has been a regular contributor to *Good Morning America* and *Inside Edition*.

Jack Anderson fascinates and educates audiences with his insights and inside stories—always standing for the public's right to know.

Former Mayor of Chicago, Jane Byrne, To Speak at FSCT Annual Luncheon

The annual luncheon of the Federation will be held on Friday, October 23, at McCormick Center Hotel. The featured speaker will be Jane Byrne, former Mayor of Chicago, whose government and political career spans four decades and who has touched people around the world with her spirit and leadership.

Long before she shocked the political world in 1979 with a stunning victory over Chicago machine politics to become the city's first woman chief executive, Ms. Byrne was honing her skills as a government administrator and political strategist.

A single mother and widow of a United States Marine Corps pilot, she joined the political campaign staff of John F. Kennedy. Through her work, she caught the attention of the late Mayor Richard J. Daley, who interested her in precinct politics. Under his leadership, she learned the basics of city politics. Soon, she was working in Chicago's federally funded anti-poverty program, and in 1968, she was appointed to the mayor's cabinet to become Chicago's Commissioner of Consumer Affairs.

For the next decade, Ms. Byrne rose in local and national political ranks to become co-chairman of the Democratic Party of Chicago and Cook County Committeewoman.

Her four years as mayor of one of the largest cities in the United States was marked by unprecedented building and financial growth, while other metropolitan areas were foundering in recession.

Ms. Byrne's deep roots in Chicago and her love for the city and government service have kept her keenly interested in politics.

Meanwhile, she has been a TV political commentator, a communications and political consultant, and lecturer on management, leadership, and politics to a variety of groups and businesses.

Ms. Byrne has spent the last three years working on her book, *My Chicago,* which was recently published by W.W. Norton & Company.

Tickets for the Luncheon may be purchased in advance or on-site at the Registration Area of McCormick Place North.

Annual Meeting Program

The theme for this year's Annual Meeting Program is "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.

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.

In addition, the 1992 Annual Meeting Program will also include the Mattiello Memorial Lecture, Roon Award papers, and Society papers. 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.

Paint Industries' Show

The largest Paint Show in Federation history will be held in conjunction with the Annual Meeting in McCormick Place North. The 57th Paint Industries' Show will feature the products and services of the suppliers to the international coatings industry. Currently, 265 companies have reserved over 91,000 sq. ft. of exhibit space to display 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.

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 $65 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.

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.

ANNUAL MEETING SPOUSES' ACTIVITES

FSCT Spouses' Activities begin on Wednesday, Oct. 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. Following 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 Penguins, the Oceanarium features an elaborate recreation 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 behavior of beluga whales and white side dolphins.

Luncheon will be served at the Mid-America Club which is located atop one of the tallest buildings in Chicago and offers a spectacular view of the city's skyline.

Comfortable walking shoes are recommended.

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

Don't Delay! Deadline for GST Rebate Approaching; Details Provided as Service to 1991 AM&PS Attendees

The following information and form are published at the request of members who attended the FSCT 1991 Annual Meeting and Paint Industries' Show, held November 4-6, in Toronto, Ontario, Canada.

Under the Goods and Services Tax (GST), most goods and services sold or provided in Canada are taxed at the rate of 7%.

Attendees at the Federation of Societies for Coatings Technology's 1991 Annual Meeting & Paint Industries' Show can claim a rebate of the GST they paid on short-term accommodations (hotel, motel, or similar lodging) and on most consumer goods they bought to take home.

The rebate application included (see next page) is divided into Sections A, B, C, D, E, and F. Claimants must fill out each section. Please remove the application and follow the detailed instructions on the opposite side. Additional information is provided for completing Sections D, E, and F.

Basic Information

You can apply for a GST rebate if:
• You are not a resident of Canada; and
• Your total claim is for a least $7 of GST [i.e., the amount you paid for purchases of goods and/or short-term accommodation in Canada is $100 (Canadian) or more].

Goods qualify for a rebate if:
• GST was paid on the goods;
• They were purchased for use outside Canada; and
• They were removed from Canada within 60 days of purchase.

Note: If the seller ships your purchase outside Canada directly, you will not have to pay the GST at the time of purchase; therefore, you will not be able to claim a rebate.

You can also claim a rebate for the GST you paid in Canada on short-term accom-

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This logo identifies the Duis Free Shops where you can obtain your rebate.

visitor rebate centre

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modation, such as hotel and motel rooms. However, if you purchase the accommodation outside of Canada (e.g., as part of a package), you will not pay the GST; therefore, you will not be able to claim a rebate.

There is **no** rebate for the GST paid on:
• Services such as dry cleaning and shoe repair;
• Goods left in Canada;
• Meals and restaurant charges;
• Camping and trailer-park fees;
• Wine, liquor, beer, or other alcoholic beverages;
• Tobacco products;
• Automotive fuels;
• Basic groceries, agricultural and fish products, prescription drugs and medical devices (no GST is paid on these goods); and
• Certain **used** goods that tend to increase in value, such as painting, jewelry, rare books, and coins. (For more details, please call 1-800-66VISIT from anywhere in Canada).

How Do I Claim My Rebate?

You can claim your rebate in one of two ways:
• By taking the completed form to a participating Canadian Duty Free Shop for a cash rebate of up to $500 (Canadian) per day; or
• By mailing the form to: Revenue Canada, Customs and Excise, Visitors' Rebate Program, Ottawa, Canada K1A 1J5.

Note: If your are applying for a GST Rebate of $500 (Canadian) or more, you **cannot** claim it at a Duty Free Shop. You **must** mail your rebate application to the previously mentioned address.

You must include the original bills of sale or the original itemized receipts with your application. Photocopies of receipts will not be accepted. Accommodation receipts must show evidence of the number of nights of accommodation supplied.

For purchases that must be registered in your own country, such as cars, you must include the original bill of sale together with a copy of the registration outside Canada.

Your original receipts together with supporting documents will be returned to you separately from your rebate check in case you want to apply for a refund of the provincial sales tax you may have paid in certain provinces. Provincial Tourist Information Centres can help you with these refund programs.

Note: The receipts you submit with your application for a provincial sales tax refund will not be returned to you. Therefore, we suggest that you claim your federal GST rebate first. Your original receipts will be returned to you so that you can claim provincial sales tax refund.

Claim Period

You have one year from the date you purchased the goods and/or accommodation to claim your GST rebate. If you mail your rebate application form, you can only apply once every three months. Please note that applications can be made at any time, in person, at participating Duty Free Shops.

Visitors to Canada who make occasional purchases of goods for their **businesses** can file one GST rebate application per month. Otherwise they must use the General Rebate Application form to claim a GST rebate on business purchases exported from Canada.

Additional Information for Completing Sections D, E, and F

Section D—Goods Purchased

You can calculate the GST paid in one of three ways depending on how the GST is shown on your receipts.
• If your receipt shows the GST separately for each item, add the GST paid on your eligible purchases and enter this total amount.
• If your receipt shows the GST as one total amount and all the items are eligible items, enter the total amount of GST. If your receipt shows the GST as one total amount, and if one or more items are **not** eligible, add the purchase price of eligible items (excluding provincial sales tax) and multiply by 7%.
• If your receipt does not identify the GST separately, but contains a statement that all amounts shown include the GST, total the net cost of each eligible item (excluding provincial sales tax) and multiply by .0654.

Section E—Accommodation Period

The GST rebate for accommodation is available to **individuals** only. To calculate your GST rebate for accommodation, use one of the following options. In some circumstances, both options may apply.

OPTION 1—ACCOMMODATION ONLY:

• If your receipt for accommodation shows the GST separately, enter the total amount of GST paid.
• If your receipt shows the GST as one total amount, add the price of accommodation (excluding provincial sales tax) and multiply by 7%.
• If your receipt does not identify the GST separately, but has a statement that all amounts shown include the GST, total the
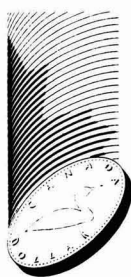
Revenue Canada   Revenu Canada
Customs and Excise   Douanes et Accise

VISITORS APPLICATION FOR REBATE OF GOODS AND SERVICES TAX
ON SHORT-TERM ACCOMMODATION AND GOODS PURCHASED IN CANADA

- In order to qualify for this rebate your goods and short-term accommodation must total at least $100 (CDN).
- This application may be mailed to Revenue Canada, Customs and Excise - GST, Visitors Rebate, Ottawa, Ont., K1A 1J5 or presented at a participating Duty Free Shop if your rebate is $500 or less.
- Please attach original receipts / supporting documents.
- Where goods have been removed over several visits attach a list showing the purchase and removal dates of each purchase.

- **Refer to the GST Rebate for Visitors Guide for detailed completion instructions.**
- **Please print or type.**

(IMPORTANT: See reverse)

A Surname / Family name / Organization / Business

Given name and initials

Street or other mailing address

City / Town / Village   State / Dept. / Province   Postal / Zip code

Country

B Type of applicant ▶ 1 ☐ Individual   2 ☐ Non-individual (Business, organization, government)

C Date of departure from Canada / Date goods removed from Canada   Y M D   Number of visits (Covered by this application)   Number of persons

D Period during which goods purchased ▶ From Y M D To Y M D   GST rebate claimed on goods ▶ $

E Accommodation period (Limit: Less than one month) ▶ From Y M D To Y M D   Number of nights

Option used to calculate accommodation rebate (See Guide) ▶ 1 ☐ and / or 2 ☐   GST rebate claimed on accommodation ▶ $

F ## CERTIFICATION

I certify that:

a) I have read and complied with the instructions outlined in the GST Rebate for Visitors Guide;
b) the information on this application and attachments hereto are true, correct and complete in every respect;
c) the above goods have been removed for permanent use outside Canada within 60 days of purchase;
d) I have not made more than one application in the calendar month (non-individual) / quarter (individual - not applicable at duty free shops) nor has this amount or any part of it been previously approved for payment or paid;
e) I am not a resident of Canada.

I also understand that this application for rebate is subject to verification.

TOTAL GST rebate claimed (minimum of $7) ▶ $

_____
Applicant's signature

_____
(Area code) Telephone number

Departmental use only

Notes

DC ☐

NC ☐

Amount approved

$

For use by Non-residents who satisfy the requirements of Part IX, Section 252 of the Excise Tax Act.
This form is prescribed by the Minister of National Revenue under the Excise Tax Act.

GST 176E (90/12)

A Identification: • Enter appropriate name and complete mailing address.
  • Only one name should be written on each application. A family may apply
    for the rebate under one name.

B Type of applicant:• Indicate whether you are claiming the rebate as an individual visitor or as a business.

C Visit information: • Enter the appropriate date (date of last departure if more than one visit).
  • Enter the number of visits to Canada. If the application includes several visits, attach a list.
  • Indicate the number of persons your application covers.

D Information on goods purchased: • Enter the earliest date and the latest date of the sales receipts accompanying your
    application.
  • Enter the actual amount of GST paid on goods eligible for the rebate.
    (additional information is provided on the following pages if required)

E Accommodation information: • Enter the first and the last date of your accommodation.
(Only individuals are eligible for an   • Enter the total number of nights claimed. (Limit: less than one month per location)
accommodation rebate)   • Indicate which option below you used. (See Guide.)
  Option one:
    Refers to short-term accommodation purchased by the individual from a hotel,
    motel or similar establishment.
      • Enter the actual GST paid shown on your receipts.
                OR
      • Enter $5 (CDN) per night if no GST is shown on your receipts.
  Option two:
    Refers to packages purchased by the individual for an all-inclusive price directly
    from a hotel, motel or similar establishment.

    Accommodation with meals and / or recreational services
      • Enter the GST paid for the accommodation portion if this amount is shown.
                OTHERWISE
      • Enter the GST shown on your receipts to a maximum of $5 (CDN) per night.
                OR
      • Enter $5 (CDN) per night if no GST is shown on your receipts.

    Note: If you bought a package which includes accommodation, meals,
        transportation fares and any other tour services, your tour operator
        deducted the amount that qualified for a rebate at the point of sale. You
        are not entitled in that case to a rebate on accommodation.

    (additional information is provided on the following pages if required)

F Total GST rebate amount and   • Add amounts entered in D & E
   certification: • Record the total (minimum claim allowed is $7 (CDN).)
  • Sign and date your application.

Mail to: Revenue Canada
    Customs and Excise
    Visitors Rebate Program
    Ottawa, Canada
    K1A 1J5 . . . . or present in person to a participating Duty Free Shop.

GST 176E (90/12)

GST Rebate Form and Other Information

Continued from page 14.

net cost of accommodation (excluding provincial sales tax) and multiply by .0654.
  • If the actual amount of GST paid is not shown on your receipts, claim $5 (Canadian) for each night.

OPTION 2—PACKAGES:
  If you have purchased a package directly from a hotel, motel, or similar establishment for an all-inclusive price that includes:

Accommodation with meals and/or recreational services:
  • Claim the GST paid for the accommodation portion of your package, if the person who provided the package has disclosed

that amount to you; or
  • Claim the GST shown on your receipts, up to a maximum of $5 (Canadian) for each night; or
  • Claim $5 (Canadian) for each night, if the actual amount of GST paid is not shown on your receipts.

Accommodation with meals, transportation, and any other tour services:
  If you bought a package from a tour operator for your visit to Canada, you are not entitled to a rebate on accommodation because the amount of tax that qualified for a rebate was deducted at the time you purchased the package.

Note: Tour operators must file for the accommodation rebate using the tour operator claim form (GST 177) designed for that purpose.

Section F—Certification
To avoid delays, be sure you have:
  • Signed your application;
  • Attached original receipts; and
  • Included additional documents for goods requiring registration.

If you are applying at a Duty Free Shop, fill in your form ahead of time because applications will be processed on the spot for claims up to $500 (Canadian). You will receive your rebate in Canadian funds.

Regulatory

UPDATE

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.

Environmental Protection Agency
April 27, 1992—57 FR 17378
Action: Notice

The U.S. Environmental Protection Agency (EPA) has published in the Federal Register its semiannual regulatory agenda for the upcoming year. The purpose of the agenda is to inform interested parties of the progress of EPA regulations. To be placed on the mailing list for further agendas, please contact Bridgette Dent, Regulation Development Branch, U.S. EPA, PM-223Y, Washington, D.C. 20460, (202) 260-5475.

The following items under the listed statutes are among those identified by EPA for regulatory activity between April 1992 and April 1993.

The Toxic Substances Control Act (TSCA)

PRERULE STAGE

1. Policy Statement Implementing the Prior Informed Consent Procedures for the Export/Import of Industrial Chemicals.
2. Environmental Hazard Communication Rule.

PROPOSED RULE STAGE

1. Addition of Air Toxics to the Toxic Release Inventory.
2. Responses to Petitions to Add or Delete Chemicals from the List of Toxic Chemicals Under Section 313 of SARA.
3. Decisions on Test Rules: Proposed Rules.
4. SARA Section 110 Chemicals Generic Test Rule.
5. Regulatory Investigation Under TSCA to Reduce Lead (Pb) Consumption and Use.
6. Proposed Follow-Up Rules on Non-5 (e) New Chemical Substances.
7. Polychlorinated Biphenyls (PCBs) Disposal Amendments.
8. Amendment to the TSCA Section 8 (a) Comprehensive Assessment Information Rule (CAIR).
9. Proposed Follow-up Rules on Existing Chemicals.

FINAL RULE STAGE

1. Decision on Test Rules: Final Rules.
2. Final Follow-Up Rules on Existing Chemicals.
3. Final Follow-Up Rules on Non-5 (e) New Chemical Substances.
4. Chemical Specific Significant New Use Rules (SNURs) to Extend Provisions of Section 5 (e) Orders.

5. Procedures and Criteria for Termination of PCBs Disposal Permits.
6. PCBs: Wet Weight/Dry Weight Clarification.
7. Section 8 (a) Preliminary Assessment Information Rules.
8. Section 8 (d) Health and Safety Data Reporting Rules.
9. Export Notification Requirements; Changes to Reporting Requirements.

COMPLETED ACTIONS

1. Toxic Chemical "Peak Release" Reporting Rule (Revision).
2. Master Testing List.
3. PCBs: Application for Exemptions from the Ban on Manufacturing, Processing, and Distribution.

Clean Water Act

PRERULE STAGE

1. Revisions to Regulations Implementing Section 403 of the Federal Water Pollution Control Act.

PROPOSED RULE STAGE

1. Federal National Pollutant Discharge Elimination System (NPDES) Fees in States where EPA Administers the NPDES Program.
2. Effluent Guidelines and Standards for the Pesticide Chemicals Category.
3. Effluent Guidelines and Standards for the Waste Treatment Category.
4. Effluent Guidelines Plan.
5. NPDES Regulatory Revisions.
6. NPDES Permit Application Standard Form A and Short Form A (Revision).
7. Denial or Restriction of Disposal Sites (Revision).

FINAL RULE STAGE

1. Water Quality Standards for Toxic Pollutants.
2. Effluent Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Category.
3. Amendments to Water Quality Planning and Management Regulations; National Pollutant Discharge Elimination System Surface Water Toxics Control Program.
4. Sewage Sludge Use and Disposal Regulations.

COMPLETED ACTIONS

1. NPDES Regulations: Storm Water Implementation Rule (Revision).

Resource Conservation and Recovery Act (RCRA)

1. Modifications to the Definition of Solid Waste and Regulations of Hazardous Waste Recycling.

PROPOSED RULE STAGE

1. Land Disposal Restrictions—Phase II: Rulemaking on Contaminated Soil and Newly Identified Wastes.

2. Land Disposal Restrictions—Phase III: Rulemaking on Newly Identified Wastes.

3. Modifications to the Hazardous Waste Recycling Regulations.

4. Causes for Permit Modifications to Hazardous Waste Management Facilities.

5. New and Revised Testing Methods Approved for RCRA Subtitle C Hazardous Waste Testing (Manual SW-846, Third Edition) Update II.

6. Identification and Listing of Hazardous Wastes—Concentration-Based Exemption Criteria.

7. Amendments to Biennial Reporting Requirements.

8. Corrective Action for Releases to Groundwater from Regulated Hazardous Waste Units.

9. Hazardous Waste Sump Requirements in Response to Rulemaking Petition (Revision).

10. Hazardous Waste Management System: Groundwater Monitoring Constituents (Phase II) and Methods.

11. Underground Storage Tanks Containing Hazardous Substances—Financial Responsibility Requirements.

FINAL RULE STAGE

1. Land Disposal Restrictions—Phase I: Rulemaking on Contaminated Debris and Newly Identified Wastes.

2. Test Methods for Evaluating Solid Waste (Manual SW-846, Third Edition) Incorporation by Reference and Mandatory Good Laboratory Practices—Update 1.

3. Hazardous Waste Management System, Amendment to Subpart C Rulemaking Petitions: Use of Groundwater Data in Delisting Decisions.

4. Liners and Leak Detection for Hazardous Waste Land Disposal Units.

5. Emission Controls for Hazardous Waste Incinerators.

6. Definition of Hazardous Waste Tank, Surface Impoundment and Waste Pile (Revision).

Clean Air Act

PROPOSED RULE STAGE

1. Protection of Stratospheric Ozone: Recycling.

2. Requirements for Enhanced Monitoring of Ozone and Ozone Precursors.

3. Enhanced Monitoring and Compliance Certification Regulations.

4. Clarification of Best Available Control Technology Regulatory Definition.

5. National Ambient Air Quality Standard (NAAQS): Lead (Review).

6. NAAQS: Ozone (Review).

7. Criteria for Imposing Discretionary Sanctions Under Title I.

8. National Emission Standards for Hazardous Air Pollutants (NESHAP): Chromium—Industrial Cooling Towers.

9. NESHAP: Chromium—Electroplating.

10. NESHAP: Organic Solvent Degreasing.

11. Statement of Policy and Procedures Regarding Petitions Under Section 112 of Title III of the Clean Air Act Amendments of 1990.

12. General Provisions for Major and Area Sources of Air Toxics.

13. Identification of Lesser Quantity Emission Rates for Major Sources Under Section 112.

14. NESHAP for Wood Furniture Manufacturing.

15. Economic Incentive Program Rules Authorized Under Title I of the Clean Air Act.

16. Protection of Stratospheric Ozone: Labeling.

17. Development of a Schedule for Regulating Source Categories of Hazardous Air Pollutants Subject to Section 112 of the Clean Air Act Amendments of 1990.

18. Compliance Extensions for Early Reduction of Hazardous Air Pollutants.

19. Guideline on Air Quality Models (Revision).

20. Protection of Stratospheric Ozone: Product Ban.

21. Treatment, Storage, and Disposal Facility—RCRA Air Emission Standards.

COMPLETED ACTIONS

1. General Preamble—Requirements for Approval of State Implementation Plan Submittals Under the Clean Air Act Amendments of 1990.

2. Designation and Classification of Nonattainment Areas.

Superfund (CERCLA)

PROPOSED RULE STAGE

1. List of Regulated Substances and Thresholds for Accidental Release Provisions: Requirements for Petitions Under Section 112 (1) (3) of the Clean Air Act Amendments of 1990.

2. Reportable Quantity Adjustments of Lead, Lead Compounds, Lead-Containing Hazardous Waste Streams, and Methyl Isocyanate.

3. Designation under CERCLA and Reportable Quantity Adjustments of New Clean Air Act Hazardous Air Pollutants.

4. National Priority List (NPL) for Uncontrolled Hazardous Waste Sites: Update 13.

5. Addition of Chemicals to the List of Extremely Hazardous Substances Based on their Physical Properties.

FINAL RULE STAGE

1. Designation of Extremely Hazardous Substances as CERCLA Hazardous Substances.

2. Reportable Quantity Adjustments of Extremely Hazardous Substances.

3. Reporting Exemptions for Federally Permitted Releases of Hazardous Substances.

4. Response Claims Procedures for the Hazardous Substances Superfund.

5. NPL for Uncontrolled Hazardous Waste Sites Updates 11 and 12.

6. Administrative Hearing Procedure for Superfund Claims.

7. Mandatory Pollution Prevention Reporting for Toxic Release Inventory (TRI).

8. Administration Hearing Procedures for Class II Penalties Under CERCLA and Emergency Planning and Community Right-to-Know Act.

Department of Labor
April 27, 1992—57 FR 16952
Semiannual Agenda of Regulations
Action: Notice

The Department of Labor has announced its semiannual agenda of regulations. The agenda has been selected for review or development for the upcoming year. For further information, contact the Office of the Assistant Secretary for

Policy, Department of Labor, Room S-2312, 200 Constitution Ave., N.W., Washington, D.C. 20210, (202) 523-9058.

The following regulations are among those scheduled for activity by the Department of Labor's Occupational Safety and Health Administration.

Occupational Safety and Health Administration (OSHA)

PRERULE STAGE

1. Exposure Assessment Programs for Employees Exposed to Hazardous Chemicals.
2. Ergonomic Safety and Health Standards.
3. Indoor Air Quality in the Workplace.

PROPOSED RULE STAGE

1. Respiratory Protection.
2. Glycol Ethers: 2-Methoxyethanol, 2-Ethoxyethanol and their Acetates.
3. Methylene Chloride.
4. Recording and Reporting Occupational Injuries and Illnesses.
5. Lead in Construction.
6. Reporting of Fatality or Multiple Hospitalizations.

FINAL RULE STAGE

1. Methods of Compliance.
2. Hazard Communication.
3. Face, Head, Eye, and Foot Protection.
4. Formaldehyde.
5. Cadmium.
6. Asbestos (Remand).
7. Accreditation of Training Programs for Hazardous Waste Operations.

COMPLETED ACTIONS

1. Hazardous Materials (Part 1910).

Department of Transportation
April 27, 1992—57 FR 17012
Semiannual Regulatory Agenda
Action: Notice

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

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

Research and Special Programs Administration (RSPA)

PRERULE STAGE

1. Hazardous Materials in Intrastate Commerce (Significant Regulation).
2. Safeguarding Food from Contamination During Transportation (Significant Regulation).
3. Transportation of a Hazardous Liquid at 20% or Less of Specified Minimum Yield Strength.
4. Specifications for Tank Car Tanks.
5. Distribution System Definitions.
6. Public Sector Emergency Response Planning and Training Grants.

7. Allocation Formula for State Grants.
8. Detection and Repair of Cracks, Pits, Corrosion, Lining Flaws, Thermal Detection Flaws, and other Defects of Tanks.

FINAL RULE STAGE

1. Training for Hazardous Materials Transportation (Significant Regulation).
2. Registration of Shippers and Carriers of Hazardous Materials.
3. Marine Pollutants (Significant Regulation).
4. Transportation of Hazardous Materials; Miscellaneous Amendments.
5. Leakage Surveys.
6. Enforcement of Motor Carrier Financial Responsibility Requirements.
7. Amendments to the Hazardous Materials Program Procedures.
8. Incorporation by Reference of Voluntary Standards.

COMPLETED ACTIONS

1. Performance-Oriented Packaging Standards (Significant Regulation).

Consumer Product Safety Commission
April 30, 1992—57 FR 18419
Lead in Paint
Action: Regulatory Investigation

The Consumer Product Safety Commission (CPSC) is considering the possibility of revising current lead paint regulations. The Commission has concluded that recent studies of lead toxicity indicate that the maximum allowable limit for lead in paint in consumer products could possibly be lowered from the current 0.06 to 0.01% by dry weight.

The Commission has requested comments and information on the proposed reduction specifically addressing the maximum allowable limit for lead in paint, exposure to lead in paint, and on uses of lead paint that are now or should be exempted from the regulation.

Comments and information will be accepted until July 14, 1992. Submissions should be identified as "Limits for Lead in Paint," and sent to the Office of the Secretary, Consumer Product Safety Commission, Washington, D.C. 20207-0001, or hand delivered to Room 420, 5401 Westbard Avenue, Bethesda, MD 20816-1469.

For further information, contact Brian Lee, CPSC at (301) 504-0994.

Environmental Protection Agency
May 4, 1992—57 FR 19166
Protection of Stratospheric Ozone
Notice of Proposed Rulemaking

As mandated by the Clean Air Act Amendments of 1990, the EPA is proposing to require warning labels on containers and products containing certain ozone depleting chemicals.

Under the proposal, EPA would also require permanent labels on products containing ozone depleting substances that can be recovered or recycled. Class I (chlorofluorcarbons, halons, carbon tetrachloride, methyl chloroform) and Class II (hydrochlorofluorocarbons) substances will be affected by the proposed rulemaking.

EPA will accept written comments until June 18, 1992. Two copies of comments should be sent to the attention of Air Docket No. A-91-60 at U.S. EPA (LE-131), 401 M Street, Washington, D.C. 20460. For further information, contact Martha Dye, Office of Air and Radiation, U.S. EPA at (202) 260-6974.

Environmental Protection Agency
May 7, 1992—57 FR 19748
Effluent Guidelines Plan
Action: Notice of Proposed Effluent Guidelines Plan

As mandated by the Clean Water Act, the EPA is required to publish an Effluent Guidelines Plan biennially. In accordance with the mandate, EPA has proposed plans for the development of new and revised guidelines which regulate industrial discharges to publicly owned treatment works and surface waters.

Comments on the proposal will be accepted until June 8, 1992, and should be submitted to Eric Strassler, Engineering and Analysis Division (WH-522), U.S. EPA, 401 M Street, Washington, D.C. 20460, (202) 260-7150.

Department of Transportation
Research and Special Programs Administration
May 13, 1992—57 FR 20424
Amendments to the Hazardous Materials Programs Procedure
Action: Final Rule

The Research and Special Programs Administration (RSPA) has amended its regulations under the Hazardous Materials Transportation Uniform Safety Act (HMTUSA) establishing a new preemption standard for state and political subdivision requirements concerning certain subjects.

The amendments to the regulation define the preemption standard and streamline its preemption determination and waiver of preemption processes. By promulgating the final rule, it is RSPA's intention to clarify the regulations and minimize the process for obtaining determinations. The rule is effective immediately.

For further information, contact Mary M. Crouter, Special Counsel, Office of the Chief Counsel (DCC-3), Research and Special Programs Administration, 400 Seventh Street, S.W., Washington, D.C. 20590, (202) 366-4400.

Product Liability—At press time, Sen. Bob Kasten (R-WI), was trying to attach language from his product liability reform legislation, S. 640, to voter registration legislation currently being debated on the Senate floor. For over a decade, Congress has tried unsuccessfully to pass legislation that would revamp the nation's product liability laws.

Supporters of Sen. Kasten's measure, including manufacturers and the insurance industry, say that product liability lawsuits carrying large jury awards place a burden on the economy by significantly increasing business costs and discouraging the development of new products.

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.

Resource Conservation and Recovery Act—During the May 13 markup of legislation to reauthorize the Resource Conservation and Recovery Act (S. 967), members of the Senate Environment and Public Works Committee defeated an amendment that would have given governors increased authority to block shipments of garbage into their states. Instead, a compromise version was agreed to that would allow the governor's increased authority only if a local jurisdiction requests the state government to ban out-of-state waste. In addition to interstate transport of waste, pending legislation would increase the nation's recycling rate, and expand regulations of municipal landfills and incinerators.

The Resource Conservation and Recovery Act (RCRA) was last revised in 1984, and Congress has had trouble agreeing on the hazardous waste provisions for the last three years. It is likely that some sort of solid waste bill will pass this year, but a comprehensive effort is very doubtful. The Environment and Public Works Committee plans to continue marking up the legislation throughout May and June.

States Proposed Legislation and Regulations

California

Labeling—CA A. 2942 (Archie-Hudson) requires that any person who manufactures or sells five-gallon, plastic, straightsided industrial containers or buckets shall place warning labels on those containers. Requires that those warning labels meet certain requirements. Provides that the State Department of Health Services shall administer and enforce these provisions. Makes violation of these provisions a misdemeanor.

Chemical Diversion—CA S. 1820 (Killea) provides that any manufacturer, wholesaler, retailer, or other person who sells, transfers, or otherwise furnishes a chemical reagent or solvent or any specified chemical substance where the value exceeds $100.00, with knowledge or reasonable cause to believe that the recipient will use the substances to unlawfully manufacture a controlled substance, is guilty of a misdemeanor.

Graffiti—CA S. 1642 (Watson) provides that nothing in the Penal Code prevents a local governing body from adopting and enforcing laws that are more restrictive than laws set forth in the Penal Code relating to the display for retail sale of aerosol paint containers, or writing or drawing instruments (with regard to possession by minors of these items for the purpose of defacing property), except as specified.

CA A. 3457 (Elder) includes graffiti abatement as a specified purpose of a community services district. Enacts procedures for the establishment of graffiti abatement districts with specified power for the purpose of abating graffiti. Authorizes districts to impose a special tax on real property for the purposes of abating graffiti. Authorizes districts to levy a tax, pursuant to the existing authority granted to cities and counties.

Labeling—CA A. 3462 (Speier) requires any supplier of any chemical containing a reproductive toxicant to disclose the health hazard or hazards of the toxicant in a label containing specified information and affixed to every container of the chemical that it supplies. Requires the employer in every workplace using a chemical in which any ingredient or contaminant is a reproductive toxicant, to ensure that every container of the chemical bears such a label.

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 Clean 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.

Colorado

Air Quality—CO S. 97 (Tebedo) 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.

CO S. 105 (Norton) concerns air pollution control, and, in connection therewith, making changes in the law to comply with and to implement the Federal Clean Air Act Amendments of 1990.

Connecticut

Occupational Safety and Health—CT H. 5069 (Committee on Labor and Public Employment) promotes health and safety in places of employment in this state by requiring each employer of 11 or more employees to establish and administer a safety and health committee.

Delaware

Superfund (Regulation)—The Delaware Department of Natural Resources and Environmental Control has proposed rules implementing the state Superfund program. The proposed rules replace interim rules adopted in April 1991. The interim rules were adopted so that the department could immediately take action on the 75 hazardous wastes sites in Delaware that are not eligible for cleanup under the Federal Superfund program. For further information, contact the Delaware Department of Natural Resources and Environmental Control, Superfund Branch, (302) 323-4540.

Hazardous Waste (Regulation)—The Department of Natural Resources and Environmental Control is proposing to amend the state's hazardous waste regulations to include tighter requirements for identifying toxicity characteristics, corrective actions, and land disposal. Affecting large and small quantity hazardous waste generators and hazardous waste treatment, storage, and disposal facilities, the amendments are a requirement for the state to obtain final authorization of its hazardous waste management program from the EPA. For further information, contact John Kinney, Program Manager for Hazardous Materials, DNREC, (302) 739-3689.

Georgia

Packaging—GA H. 124 (Dobbs) relates to waste management, so as to provide for the reduction of toxic heavy metals in packaging waste.

Hazardous Waste—GA H. 1394 (Porter et al.) also known as the state Superfund bill, is designed to help identify, investigate, and cleanup hazardous waste sites in the state. Annual fees will be imposed on a per ton basis for hazardous waste disposal, incineration, treatment, storage, recycling, or re-use on or off the premises. Fees paid by hazardous waste generators and transporters will fund the program which will target contaminated sites that are not eligible for Federal cleanup money.

Illinois

Spray Paint—IL H. 3423 (Burke) provides that anyone selling aerosol paint in the City of Chicago would be guilty of a misdemeanor.

Lead—IL H. 3638 (Stephan) amends Lead Poisoning Prevention Act by implementing proposals contained in a report issued by the special Joint Task Force on Childhood Lead Poisoning. A "shell" bill was released by the House Committee on Health Care on April 29. Major substantive amendments are expected.

IL H. 4064 (Schoenberg) amends the Environmental Protection Act; imposes a fee on facilities that emit toxic air pollutants of five cents per pound of toxic air pollutants emitted (facilities subject to the fee would be those required to file reports under SARA 313); provides that fees shall be deposited into the Toxic Air Pollution Reduction Fund.

Iowa

Lead—IA H. 2439 (Committee on Energy and Environmental Protection) relates to lead abatement by establishing a Lead Inspection and Abatement Program and provides a penalty.

Louisiana

Lead—LA H. 1869 (Ansardi), LA S. 949 (Brinkhaus), and LA S. 704 (Kelly) would permit a specific time period during which lawsuits concerning lead-based paint abatement may be filed that otherwise would be barred by the statute of limitations.

Maine

Lead—ME H. 1584 (Mitchell et al.) amends laws governing lead poisoning control so as to make achievable the goal of eliminating lead poisoning of children in the state; establishes the Public Health Lead Poisoning Advisory Committee and outlines the duties and responsibilities of the advisory committee in counseling the Department of Human Services in rulemaking, administrative, and enforcement functions; defines what constitutes a hazard from exposed lead; etc.

Packaging (Regulation)—The Maine Waste Management Agency is proposing a rule implementing the provisions mandated by Public Law 808 regarding the reduction of toxics in packaging. Under the law, lead, cadmium, mercury, or hexavalent chromium may not be intentionally introduced into any package or packaging component for use or sale in the state after April 1, 1992. The sum of toxics "incidentally" present may not exceed 600 ppm after April 1, 1994, 250 ppm after April 1, 1995, and 100 ppm after April 1, 1996. Exemptions include: (1) packages containing a code indicating that the date of manufacture is prior to April 1, 1992; (2) a petition to the agency for an exemption due to (a) health and safety requirements (granted up to two years), (b) the existence of no feasible alternative (granted for up to two years), (c) the addition of post consumer materials (expires April 1, 1996 and the entire package is exempt if all components contain recycled content), and (d) another Northeastern state has exempted the package or component.

Maryland

Lead—MD H. 1265 (Rosenberg and Thomas) establishes the Lead Paint Poisoning Prevention and Compensation Commission for the purpose of preventing lead paint poisoning; assists those persons who have been lead poisoned; finds effective methods for the management of lead in dwelling units and property; provides and preserves safe and affordable housing; requires the commission to assess and collect fees, as specified; and establishes a Lead Paint Prevention and Compensation Fund.

Massachusetts

Packaging—MA H. 2648 (Vellucci) bans the sale of certain mixed material containers in the Commonwealth; provides that no dealer shall sell or offer for sale in the

Commonwealth containers composed of aseptic packaging containing metal, or paper and plastic in combination, where those materials in such containers are for practical reasons inseparable with regard to recycling processes, unless an annual recycling rate is being achieved such that at least 35% of such containers used in the Commonwealth are being recycled.

Paint—MA S. 383 (Tisei) requires the licensing of painting contractors.

Lead—MA H. 5514 (Jehlen) relates to the reduction and prevention of childhood lead poisoning.

Automotive Paint—MA H. 4814 (Valianti) regulates the sale of automotive paint products and paint by-products.

Michigan

Packaging—MI H. 5806 (DeBeaussaert) eliminates certain heavy metals in consumer packaging from solid waste under the Solid Waste Management Act.

Minnesota

Solvent Abuse—MN S. 979 (Pappas et al.) relates to glue and solvent sales to minors. Adds butane compounds to the list of restricted items which may not be sold to minors.

Lead—MN S. 1790 (Berglin) relates to lead abatement and education programs; reduces standard for elevated blood lead levels to 10 micrograms in children up to age six and pregnant women, and requires state program providing a proactive lead education program; includes cleaning-up and swab team services; requires Board of Health to provide health education to parents of children with certain levels of blood lead.

Mercury—MN H. 2147 (Wagenius et al.) relates to recycling requirements; prohibits, as of August 1, 1992, the placement of mercury in a solid waste or any processing or disposal facility; bars sales of mercury without a material safety data sheet and requires purchasers to sign statements that they will not place mercury in the solid waste stream; requires labeling of products containing mercury.

Packaging—MN H.F. 779 (Munger) requires registration of products containing "priority toxics"; imposes fees for registration of products based on quantity of toxics contained in products sold in Minnesota.

Missouri

Hazardous Waste (Regulation)—The Department of Natural Resources has proposed rules that would subject to stricter standards facilities that burn hazardous wastes as supplemental fuels in boilers and industrial furnaces. Under the proposal, facilities that thermally, chemically, physically, or biologically treat or blend hazardous wastes before burning will have to meet treatment and permit standards. Resource recovery permits would also be required for facilities recovering metals from hazardous wastes.

New Hampshire

Packaging—NH H.C.R. 21 (Bradley) urges U.S. Congress to adopt uniform recycling product labeling standards based on standards developed by the Northeast Recycling Council.

New Jersey

Lead—NJ A. 1350 (Charles) establishes certification program for lead abatement workers and inspectors.

New York

Aerosols—NY S. 6978 (Levy) prohibits the sale of aerosol spray paint cans containing a fluid that is not water-soluble to any person under 18 years of age.

Toxic Chemical Release—NY A. 3845 (Hinchey et al.) 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.

Graffiti—NY A. 10496 (Seminerio) prohibits the making of graffiti and possession of graffiti instruments.

NY S. 1592 (Padavan) imposes criminal sanctions upon persons who deface public or private property by means of aerosol paint cans.

NY S. 2369 (Padavan) 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.

NY S. 4750 (Padavan) regulates the sale of aerosol paint cans and broad tipped indelible markers in the City of New York.

NY S. 7572 (Maltese) prohibits the making of graffiti and possession of graffiti instruments.

Oklahoma

Solid Waste—OK S. 683 (Giles and Leist) allows a higher fee to be charged for disposal of solid waste imported into the state than for waste generated within the state. The fee can be as much as 10 times the fee charged for in-state waste disposal. The law requires solid waste disposal facilities to provide a disclosure statement and to operate under a permit issued by the Department of Health. A plan for site closure and a 30-year monitoring provision must be included in the permit.

Air Quality—OK H. 1044 (Peltier) memorializes Congress to pass laws which allow states more flexibility in financing requirements of the Clean Air Act.

Tennessee

Storm Water—TN S.B. 2693 (Atchley and Henry) authorizes local governments to regulate storm water discharges and establish drainage and flood control systems when municipalities are subject to EPA regulations.

Automotive Paint—TN H. 2591 (Kisber) provides 100% tax credit for cost of pollution controls purchased by automobile body paint shops.

Federation of Societies for Coatings Technology

1992 Annual Meeting & Paint Industries' Show

Hotel Information/Reservation Application
• Advance Registration Form •

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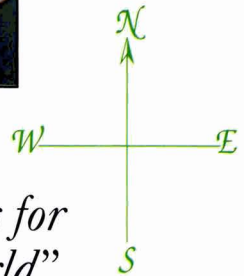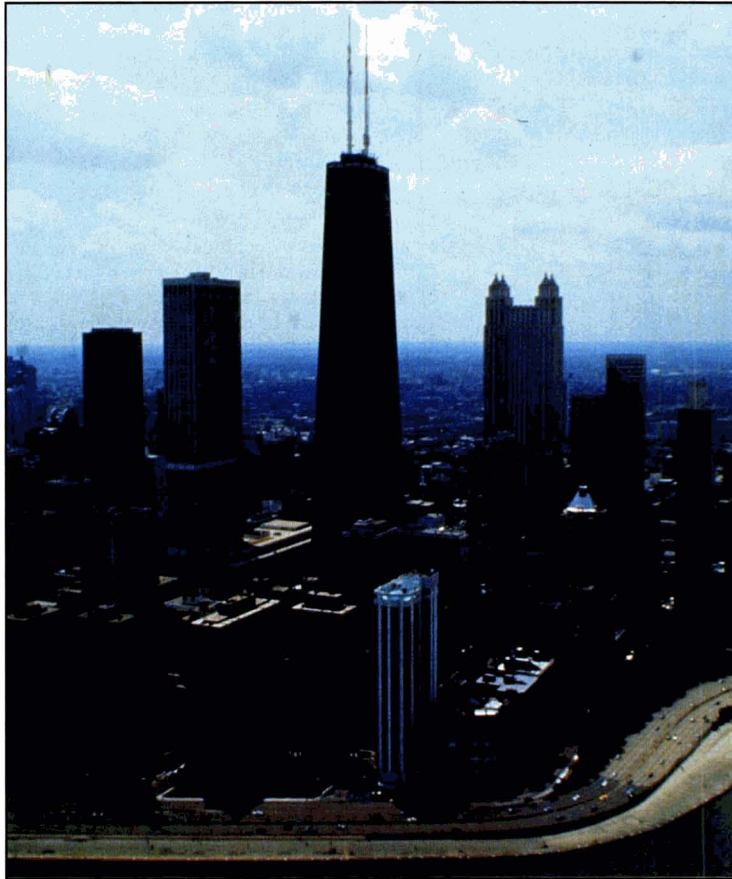
*"New Directions for
a Changing World"*

McCormick Place North
Wednesday, Thursday, Friday • October 21-22-23, 1992
Chicago, Illinois
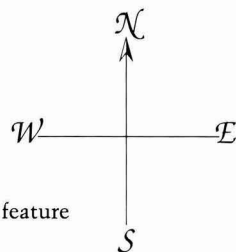
"New Directions for a Changing World"

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.
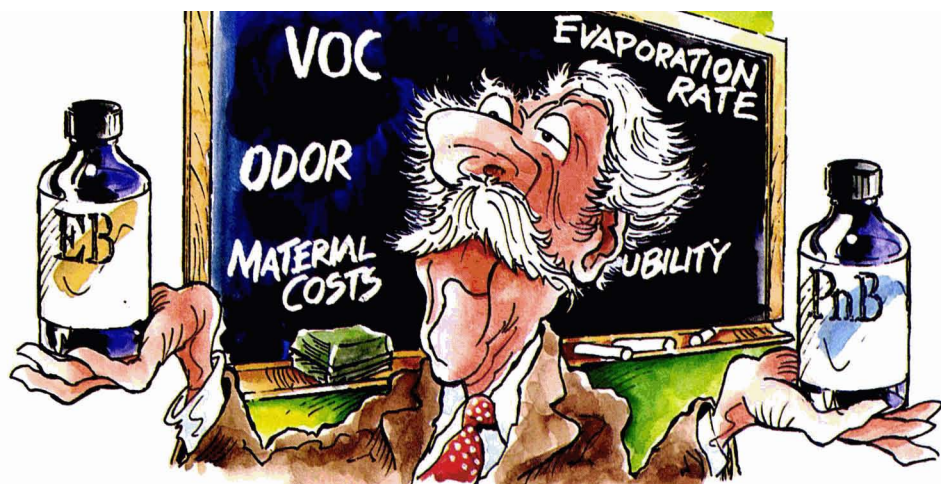
Considering Alternatives to E-Series Glycol Ethers? DOWANOL PnB and DPnB Reduce Handling Concerns and Deliver Comparable Solvent Performance.

There are no such things as drop-in replacements for familiar E-series glycol ethers. However, DOWANOL* PnB and DPnB P-series glycol ethers can offer surprisingly similar performance in both industrial and architectural formulations.

DOWANOL PnB: Fast Hardness Development Like EB in Industrial Formulations

When you want fast evaporation, DOWANOL PnB (propylene glycol n-butyl ether) performs almost identically to EB glycol ether. The efficiencies of PnB and EB in lowering minimum film formation temperatures (MFFT's) are in the same range. And as the example in Figure 1 shows, their hardness development rates in typical industrial latexes are very similar.

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

DOWANOL DPnB: High Efficiency, Easier VOC Compliance, and Lower Odor

DOWANOL DPnB (dipropylene glycol n-butyl ether) is a good alternative to DB glycol ether. While their evaporation rates are similar, DOWANOL DPnB can offer better MFFT-lowering efficiency than DB (Figure 2). And since DOWANOL DPnB has much lower water solubility, it's less likely to cause compatibility problems with associative thickeners.

In addition, DOWANOL DPnB often provides greater coalescing efficiency than popular ester-alcohols in acrylic-based architectural latex formulations. So for about the same formulated cost, you can reduce both VOC's and odor levels.
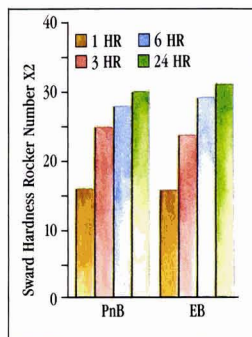
Figure 1 – Hardness Development Rates in Typical Acrylic-Based Latex
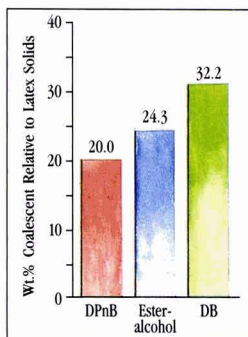
Figure 2 – Coalescent Levels Required for 50°F MFFT in Typical Acrylic-Based Latex

Answers to Reformulating Questions

With our extensive reformulating database, we can help make your switch to P-series alternatives easier. If you need to fine-tune solvent performance to address specific temperature and humidity considerations, we can offer unmatched assistance.

Call Today For Literature and Samples

It's easy to learn more about DOWANOL PnB or DPnB and how they may be ideal alternatives in your current formulations. Our 20-page brochure provides comprehensive information, and we'll be glad to provide samples for your evaluation. Just circle the reader service number below. Or call us toll-free at: 1-800-447-4369.

Dow

*Trademark of The Dow Chemical Company

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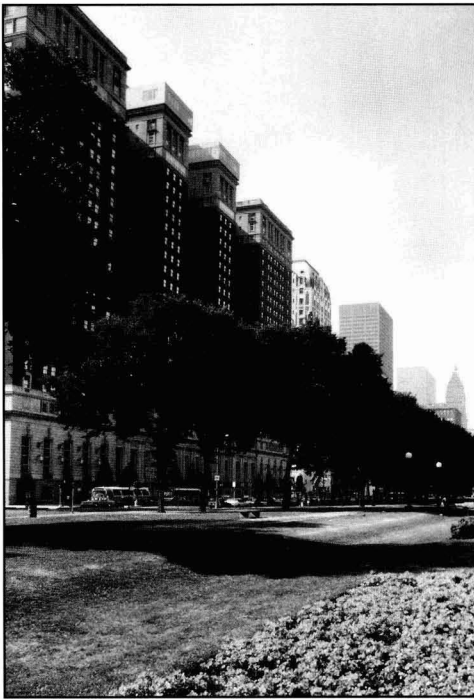
The Chicago Hilton—headquarters hotel for the FSCT Annual Meeting & Paint Industries' Show

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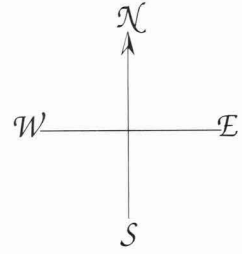
Essex Inn on Grant Park
Across from Grant Park and close to the FSCT headquarters hotel. Free courtesy shuttle downtown. New York style deli and lounge. Outdoor heated pool. Free parking for guests. Airport limousine service.

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

FSCT 1992 — 70th Annual Meeting & 57th Paint Industries' Show

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

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

SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:

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

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

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.
Ambrose Co.
ACS/C&E News
ACS/Industry Relations
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.

Sandoz Chemicals Corp.
Sanncor Industries, Inc.
Sartomer Co. Inc.
Schold Machine Corp.
SCM Chemicals
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.
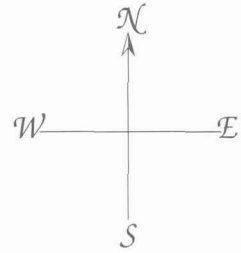
FSCT Board of Directors to Meet On Tuesday at Chicago Hilton

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.
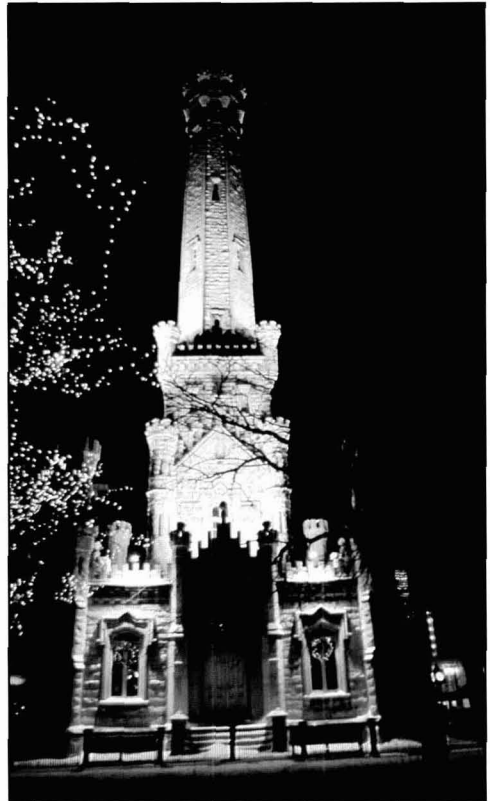
Photo courtesy of Ron Schramm/Chicago Convention & Tourism Bureau

Chicago's famous landmark— Water Tower Place

Approval Received to Proceed with AIM Reg Neg Process; Paint Industry to Perform VOC Emissions Survey

According to the National Paint and Coatings Association, Washington, D.C., the decision to proceed with regulatory negotiations (reg-neg) to draft a national rule limiting volatile organic compound (VOC) emissions from architectural and industrial maintenance (AIM) coatings was unanimous. The voting took place at the second "exploratory" meeting of all interested parties, on April 15-16, in Raleigh, NC.

The final decision whether to proceed with the reg-neg process will be made by the U.S. Environmental Protection Agency (EPA), based on the recommendations of The Keystone Center, the agency's independent convener for the effort.

If the EPA decides to proceed with reg-neg, the agency will publish a *Federal Register* notice that includes a description of the subject and scope of the proposed rule, with a proposed agenda and schedule; a list of potential interested/affected parties and a list of persons to represent these parties; a solicitation of comments on the proposed scope of the negotiation; and an explanation of how a person might apply for membership on the Negotiating Committee.

Meanwhile, the paint and coatings industry will proceed with a VOC emissions data collection survey for AIM coatings as agreed to by the participants at the second exploratory meeting. The survey, which is being coordinated by NPCA, was tentatively scheduled to begin in the early part of this month and is to be completed by late August.

Definitions of categories of coatings for the survey also were approved by meeting participants, which included representatives from state and local regulatory agencies, environmental interest groups, industry, trade associations, EPA, and The Keystone Center.

Some of the additional items on the meeting's agenda included:

• The scope of the rule/who will be regulated (tentatively listed as manufacturers, processors, wholesale distributors, importers);

• Industry profile (part of an ongoing educational process by industry of regulators and the environmental community);
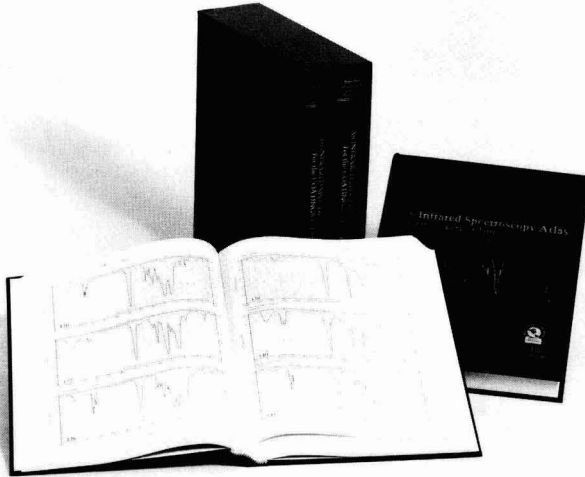
• Details on an ongoing EPA study of VOC emissions from consumer and commercial products that is due to Congress in late 1993 (data generated during the reg-neg process will be included as part of the study);

• Possible regulatory frameworks that could be applied to AIM coatings (control-and-command approaches, market-based incentives, etc.);

• Hazardous air pollutants issues that may impact industry; and

• An overview of the reg-neg process, its legal basis, and how it works (protocols, participants, consensus building, timeframes, etc.).

The reg-neg process is designed to be an open exchange of ideas and opinions involving any and all interested parties in the development of a rule. Its purpose is to develop a consensus regulation with representatives of the interested parties to minimize controversy, litigation, and delay.

Amoco Petroleum Additives To Restructure Operations

Amoco Petroleum Additives Company, Clayton, MO, a subsidiary of Amoco Chemical Company, Chicago, IL, has announced that it is restructuring its worldwide additives operations.

As part of the restructuring, Amoco Petroleum Additives will close or sell its research laboratory in Stevenage, United Kingdom, and phase out direct marketing activities in Europe this year. The restructuring will affect 47 Amoco employees.

According to officials at the company, if the buying organization does not have positions for some of the employees, then Amoco will attempt to find positions for the employees or offer them a severance package.

Paint Consultant Sought For One-Month Assignment in Hanoi, Vietnam

The Department of International Activities of the American Chemical Society (ACS), Washington, D.C. is searching for a volunteer consultant specializing in the manufacture of water-soluble and alkyd paints for a one-month tour in Hanoi, Vietnam. The volunteer request was made to ACS from the Office of Short-Term Advisory Resources (STAR) of the United Nations Development Program (UNDP), New York, NY.

Because of limited funds, the UNDP STAR Program will only provide the candidate with travel and per diem expenses reimbursement. No honorarium is available.

The program does provide an opportunity for international experience and contact development in Asia. Also, the position might be of interest to a retired specialist who would like to see Asia.

The paint specialist chosen for the one-month consultant assignment in Vietnam will work out of the Hanoi Synthetic Paint and Printing Ink Facility which specializes in manufacturing paints and printing inks. The company's product line consists of alkyd resins, phenol, melamin, urer, and formaldehyde resins, and processing of paints and printing inks. Hanoi Synthetic Paint's annual production is 1,000 tons/year, and annual sales are $2 million/year. The company employs 300 people and is a domestic market producer. In addition, the facility's production lines were installed in 1970-74.

The consultant /paint specialist will be expected to make the most of the capacity of the old production line, and determine the optimal technology for the company's line of products. Candidates for the one-month position are required to have a B.A. or M.B.A. Degree in paint technology. Also, 10 years of technological experience in management and production of paints is requested.

For more information on this temporary consultant position, contact Dr. J.C. Torio, Dept. of International Activities, ACS, 1155 Sixteenth St., N.W., Washington, D.C. 20036. Telephone: (202) 872-4548; Fax: (202) 872-6317.

Construction Contracting Gains Six Percent in February; Reaches Highest Level in More Than 18 Months

The construction contracting for new projects climbed six percent in February according to a report by the F.W. Dodge Division, McGraw-Hill, Inc., New York, NY.

The increase in February contracting was realized in three broad categories of construction—housing, nonresidential building, and public works/utilities. This recent gain brought construction contracting back to a level not seen in more than 18 months.

Sources at McGraw-Hill have indicated that construction contracting is almost 15% above 1991's average level.

February's leading industry was non-residential building which reported a 12% increase. This gain was attributed largely to contracting for commercial and institutional building projects. Educational and health care facilities showed better-than-average gains. However, the commercial real estate market's problem areas, offices and hotels, did not show any increase in February.

Construction contracting for residential building rose three percent in February. Improvement was concentrated in single-family housing.

Currently, the year's largest gains in housing are found in the North Central and South Central areas.

During the past several months, contracting for nonbuilding construction (public works and utilities) has added a secondary level of support in addition to the recovery of the housing market. Acceleration of Federal spending for ongoing public works programs and the implementation of the new six-year, $155 billion transportation act (ISTEA) have escalated the large public works component of this category since December of 1991. A rise of electric utility projects helped boost total nonbuilding construction contracting another four percent in February.

The unadjusted total of contracting for new construction in January and February was $33 billion, an increase of 16% above 1991's value for the same period. The South Central region, where contracting was up 18%, was closest to the national average.

The Northeast and North Central regions, with gains of 24% and 30% respectively, showed the biggest improvement, while the South Atlantic and the West posted increases of seven percent and six percent respectively.

Engineered Coatings Unveils New Facility in Rocky Hill, CT

Engineered Coatings, Inc. has announced the opening its new offices and thermal spray coatings facility in Rocky Hill, CT.

The new state-of-the-art facilities are equipped with robotics for work handling, high precision calibration equipment, and high volume manufacturing capability with both batch production and continuous flow processing under normal atmospheric conditions. A high-tech vacuum spray facility is available for processing high quality metals and other coatings in a controlled environment. A metallographic laboratory is used for material characterization and process verification.

Also, an advanced air filtration system is designed to purify the air prior to leaving the facility's environment.

Engineered Coatings formerly was a part of United Technologies for over 15 years and served as an in-house resource for developing unique capabilities in material selection and characterization, coating design, and process control of thermal spray coatings.

NPG Glycol Expansion Completed at Eastman Plant

Eastman Chemical Company, Kingsport, TN, has completed a previously announced expansion of its production facilities for NPG Glycol.

The multimillion-dollar expansion took place at Eastman's Longview, TX facility. The plant is now capable of producing 57,000 MT per year of NPG in bulk bags.

Also, Eastman stated that plans for an NPG plant in Europe have been delayed.

Cray Valley to Increase Resin Capacity at Two Plants

Cray Valley Ltd., United Kingdom, has announced an investment program aimed at increasing resin capacity at Machen, Gwent, and Stallingborough, Humberside.

Additional funds are targeted for investment in computerization and automation of production facilities. Also, monies are allocated for the relocation of Cray Valley headquarters from Kent to Machen.

Mergers & Acquisitions...

Akzo Sells Specialty Chemicals Company to Dynaction S.A.

Akzo nv, Arnhem, The Netherlands, and Dynaction S.A., Boulogne, France, have agreed on the sale of Produit Chimiques Auxiliaires et de Synthese to Dynaction.

The company develops, produces, and markets specialty chemicals for the pharmaceutical, agrochemical, aroma, lubricant, and photochemical industries.

Produit Chimiques Auxiliaires is headquartered in Longjumeau, France, and has production plants in Couterne and Bourgoin, France. Currently, the company has 370 employees.

* * * * * * * * * *

TA Instruments Forms New Subsidiary in Japan

TA Instruments, Inc., New Castle, DE, has announced the formation of its wholly-owned subsidiary, TA Instruments Japan, Inc. The new company, headquartered in Tokyo, Japan, officially began operations in April.

TA Instruments Japan will operate under the direction of N. Urayama.

* * * * * * * * * *

ICI Paints Packaging Group and Nippon Oil Form Partnership

The ICI Paints World Packaging Group and Nippon Oil and Fats Company Ltd., Japan, have formed a partnership to manufacture, distribute, and service ICI Paints packaging coatings for beverage and food cans and closures in Japan.

The venture will be supported by significant investment at the Nippon Oil and Fats Company's Totsuka facility.

The ICI Paints World Packaging Group is comprised of packaging coatings companies in Europe and North America, including Holden Surface Coatings, United Kingdom; Holden Europe, France; ICI Lacke Farben (formerly Wiederhold), Germany; and The Glidden Company, Cleveland, OH.

Use of a Mathematical Model
To Predict the Effects of Extenders
On Pigment Dispersion in Paint Films

J. Temperley, M.J. Westwood, M.R. Hornby, and L.A. Simpson
Tioxide Group PLC*

A mathematical model to predict the packing of particles in pigmented films has been developed. A Monte Carlo method is used to generate random positions in a box for spheres with a specified size distribution and desired volume concentration. The nearest neighbor distribution gives an indication of dispersion.

The results, for spheres clustered according to a Smoluchowski distribution, compare well with electron micrographs of pigmented films. This model has been used to study the effect of pigment crystal and particle size on dispersion. The results highlight the spacing advantages of a larger crystal size.

This approach has also been used to predict the effect of extender particles on pigment dispersion. The model suggests that small particle size extenders (ca. 0.1 μm) should improve pigment spacing and, therefore, scattering efficiency. However, for larger extenders (at a fixed pigment loading), as extender volume concentration is raised, pigment spacing decreases. Results from the model suggest that an increase in the width of the extender size distribution can improve pigment dispersion.

INTRODUCTION

Titanium dioxide (TiO_2), with its high index of refraction, is the primary opacifying pigment used in most paints. The opacity of a film pigmented with TiO_2 is dependent on the distribution of the individual crystals in the medium. Within a well-dispersed paint film, only 20-30% of the pigment may be present as single crystals since residual aggregation and flocculation generally reduce the number of primary particles.[1]

As the pigment loading in a well-dispersed paint film is raised, opacity (as measured by backscattering coefficient) increases approximately linearly up to a pigment volume concentration (PVC) of about 10%.[2] Beyond this point, the relationship becomes nonlinear and at high pigment loadings (e.g., PVC greater than 30%) a reduction in scattering occurs. This decrease in scattering results from interference effects due to the close proximity of the pigment particles to each other. Crowding of pigment particles thus reduces their scattering efficiency.[3,4]

An increase in pigment crystal size is one way to improve pigment spacing, particularly at high PVC.[5] However, for many years it has been suggested that the use of fine-particle size extenders can enhance the light scattering ability of TiO_2.[3,4,6-10] Such extenders are proposed to act as diluents or "spacers," reducing loss of scattering from crowding. A model to predict the effect of extenders on pigment dispersion in paints would therefore be of great potential use.

Micrographs of low PVC paint films generally show a fairly random distribution of TiO_2 particles,[4] with cluster sizes similar to those calculated by a Smoluchowski distribution.[1] To predict this type of dispersion, a mathematical model has been developed which is therefore based on random packing of particles within a "paint-film." The Smoluchowski distribution was used to describe the pigment "cluster" population. This simple model was then modified to include randomly packed extender particles in the calculation. The effect of extender particles (and their size) on pigment crowding has been studied using this model.
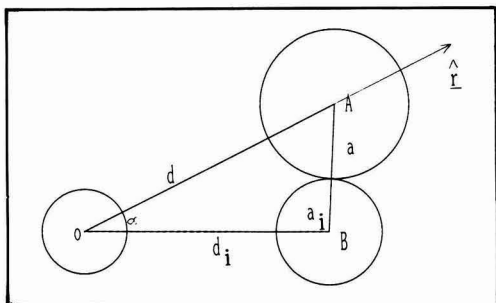
Figure 1—Assembly of a cluster from two spheres

THE MATHEMATICAL MODEL
AND ITS APPLICATIONS

Outline of Method

The technique belongs to the class known as Monte Carlo methods. In the current study, a geometrical description is built of a typical test volume of the paint film in question. This model is generated from the known characteristics of the film constituents (e.g., pigment crystal size distribution, PVC, and degree of flocculation). The development of this description proceeds through the generation of pseudo-random numbers, which are made to represent the elements (e.g., pigment crystals as spheres) and their disposition relative to one another within the film. Once the geometrical picture has been formed in three dimensions, a statistical measure of the dispersion can be calculated (e.g., the nearest neighbor distribution of the spheres) and is taken to be representative of the film as a whole.

Input to the computer program (which uses FORTRAN 77, Digital Electronics Corporation) consists of volume concentration, sphere weight mean size, and its geometric standard deviation (GSD). The distributions are assumed to be approximately log-normal for the purposes of this study, but it would be straightforward to include other distribution functions. Single crystal fraction (f_1) is also specified and the cluster (particle) size distribution is calculated by the program using the Smoluchowski aggregation law.

RANDOM NUMBER GENERATION: Uniform random numbers were generated using a variety of methods;[11] most of these were based on the power residue method. Although the power residue method is notorious for producing unwanted correlations, no serious shortcomings were observed in this study. The power residue method gives a sequence of pseudo-random numbers, I_r, [equation (1)], for chosen values of the integers A, B, and m. The recurrence relation will generate all values between zero and m in an apparently random order.

$$I_{r+1} = AI_r + B \qquad (1)$$

Random numbers, Z_r, in the range zero to one are obtained by normalization [equation (2)]. The standard generator provided with DEC Fortran[12] was found to produce satisfactory results and has been used in this paper.

$$Z_r = I_r / m \qquad (2)$$

A random deviate with any desired distribution function can be readily obtained provided that the cumulative distribution function is known and invertible. Thus, if the function $\Phi(x)$ represents the fraction of a distribution less than x, then x_r [equation (3)] will have the desired properties.

$$x_r = \Phi^{-1}(Z_r) \qquad (3)$$

SIZE DISTRIBUTIONS: An approximately log-normal shape has been assumed for the size distribution of all components in the study. The defining parameters have been taken to be the geometric weight mean diameter and the GSD. The sphere (crystal) size distributions were generated via an approximation to the Normal (or Gaussian) distribution based upon a generalized shape due to Burr.[13] Burr proposed the general cumulative form [equation (4)] as having several useful features. The inverse function can be immediately written as equation (5). For suitable choices of the parameters k and c, this function can give a wide range of distribution shapes. When

$$\Phi(x) = 1 - (1 + x^c)^{-k} \qquad (4)$$

$$x = \Phi^{-1}(z) = \left[\frac{1}{(1-z)^{1/k}} - 1 \right]^{1/c} \qquad (5)$$

$k = 5$ and $c = 4$, the shape is very close to Gaussian with mean and variance given by equations (6) and (7). Hence, if Ω is required to have an approximately Gaussian distribution with mean μ and standard deviation σ, x can be calculated as previously mentioned with Ω given by equation (8).

$$\mu_o = \frac{\Gamma(1/c)\,\Gamma(k-1/c)}{c\,\Gamma(k)} \qquad (6)$$

$$\sigma_o^2 = \frac{2\,\Gamma(2/c)\,\Gamma(k-2/c)}{c\,\Gamma(k)} - \mu_o^2 \qquad (7)$$

$$\Omega = \mu + \frac{\sigma}{\sigma_o}\cdot(x-\mu_o) \qquad (8)$$

where:

$$\Gamma(n) = \int_0^\infty x^{n-1}\,e^{-x}\,dx$$

For the crystal size distribution in this work, it is required that the *logarithm* of the sphere diameter has a Gaussian distribution with a mean, $\ln d_w$, and a standard deviation, $\ln \sigma_w$. The diameter, d, is therefore given by equation (9).

$$d = \exp\{\ln d_w + \ln \sigma_w \cdot (x-\mu_o)/\sigma_o\} \qquad (9)$$

CLUSTERS: There is the potential for great variety in these studies by varying the manner in which the clusters/flocculates of spheres are generated. However, the cluster population for this work has been assumed to follow a Smoluchowski aggregation law [equation (10)] where f_1 is the fraction of spheres present as singlets and P_n is the fraction of particles of size n.

$$P_n = f_1^{1/2}(1-f_1^{1/2})^{n-1} \qquad (10)$$

Clusters may be generated in two ways: homogeneous (where all spheres in any given cluster are from the same

Table 1—Effect of Single Crystal Fraction (f_1) and Extender Size on TiO₂ Particle Mean NN Distance (μm) at 13% TiO₂ Volume Concentration^a

Extender Volume Concentration/%	Extender Size/μm	f_1	Mean Pigment NN Distance/μm
13..............	0.5	0.1	0.317 (9)
13..............	0.2	0.1	0.355 (10)
13..............	0.1	0.1	0.510 (7)
13..............	0.5	0.2	0.177 (3)
13..............	0.2	0.2	0.211 (6)
13..............	0.1	0.2	0.280 (3)
13..............	0.5	0.3	0.120 (4)
13..............	0.2	0.3	0.157 (6)
13..............	0.1	0.3	0.227 (7)

(a) Standard errors of the mean NN distance are given in parentheses (for the least significant digits).

paint component) and heterogeneous (where a cluster may be composed of more than one constituent, e.g., extender and pigment).

Individual spheres in a cluster are arranged as follows. The first (or only) sphere in a cluster determines the cluster origin. Subsequent spheres are generated in turn and brought into the cluster along random directions radiating from this origin. The spheres become fixed upon their first encounter with a sphere already in the cluster. For example, considering *Figure 1*, suppose the randomly chosen direction for a new sphere is r̂ (where r̂ is a unit vector) and the randomly generated radius of the new sphere is a. The potential encounters between the new crystal and existing crystals within the cluster must be considered. In the triangle AOB:

$$(AB)^2 = (OA)^2 + (OB)^2 - 2 (OA)(OB) \cos\alpha$$

i.e.,
$$(a + a_i)^2 = d^2 + d_i^2 - 2 d d_i \cos\alpha \tag{11}$$

$$d = d_i \cos\alpha \pm \sqrt{\{ (a + a_i)^2 - d_i(1 - \cos^2\alpha) \}} \tag{12}$$

Equation (11) leads to solutions for d [equation (12)]. Since the cluster is being built by bringing the extra crystal in along direction r, the plus sign in equation (12) is selected and the chosen resting place is the one which provides the largest value of d derived from all existing crystals. Note that if $(a + a_i)^2 < d_i(1 - \cos^2\alpha)$, there is no real root and therefore no encounter with the test crystal.

SPATIAL COORDINATES: Having generated a cluster, attempts are made to fit this into the preselected test volume. The location of the cluster origin is generated at random. Tests are then carried out to determine whether the cluster can be placed at this point without impinging on clusters which are already in place. If not, a new random location is generated and tested.

Film and Dispersion Considerations

COMPONENT CONCENTRATION: Throughout the generation and placement of clusters, a running total of solids concentration is maintained. The process is terminated when any of the constituents reaches its specified, predetermined concentration.

Suppose the test volume has dimensions L_X, L_Y, L_Z in each of the three coordinate directions and d_p is the diameter of a sphere (or crystal) of the component in question. The volumes of the test space, V, and the sphere, V_p, are easily obtained [equations (13) and (14), respectively]. The volume concentration of the selected component, C_p, is given by equation (15). Note that this is in error by including parts of spheres which fall outside the test volume and excluding external spheres which might intrude upon the test volume. While these effects are compensatory, their full implication has not been exhaustively investigated and it is necessary to keep them to a minimum by choosing L_X, L_Y, L_Z much larger than the crystal diameters.

$$V = L_X . L_Y . L_Z \tag{13}$$

$$V_p = \frac{\pi d_p^3}{6} \tag{14}$$

$$C_p = \frac{1}{V} \cdot \sum_p V_p \tag{15}$$

SIZE DISTRIBUTION: Upon completion of the generation process, the weight mean size and GSD of each constituent are calculated using the data generated during the placement process. The geometric weight mean diameter, D_w, and the geometric weight standard deviation, S_w, are given by equations (16) and (17), respectively.

$$\ln D_w = \frac{\sum (\pi d^3 / 6) \cdot \ln d}{\sum (\pi d^3 / 6)} \tag{16}$$

$$\ln^2 S_w = \frac{\sum (\pi d^3 / 6) \cdot \ln^2 d}{\sum (\pi d^3 / 6)} - \ln^2 D_w \tag{17}$$

A comparison, with the mean and standard deviation specified on input, can then be made. If the output weight mean size differs from the input size by greater than ±0.01 μm (or if the input and output GSDs differ by greater than ±0.02), the generation process is repeated.
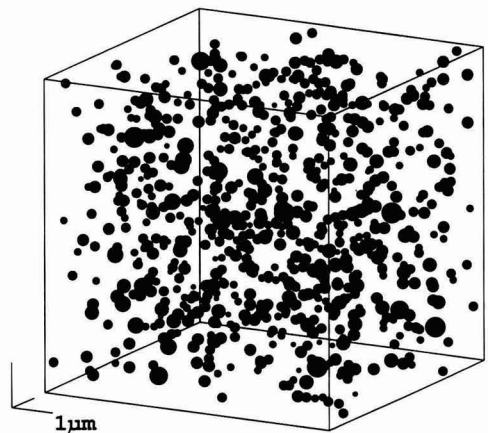
Figure 2—Dispersion simulation—a typical plot obtained from the model. Data: TiO₂ volume concentration = 1%, weight mean size = 0.22 μm GSD = 1.3

(a)

⊢——⊣
1 μm

(b)
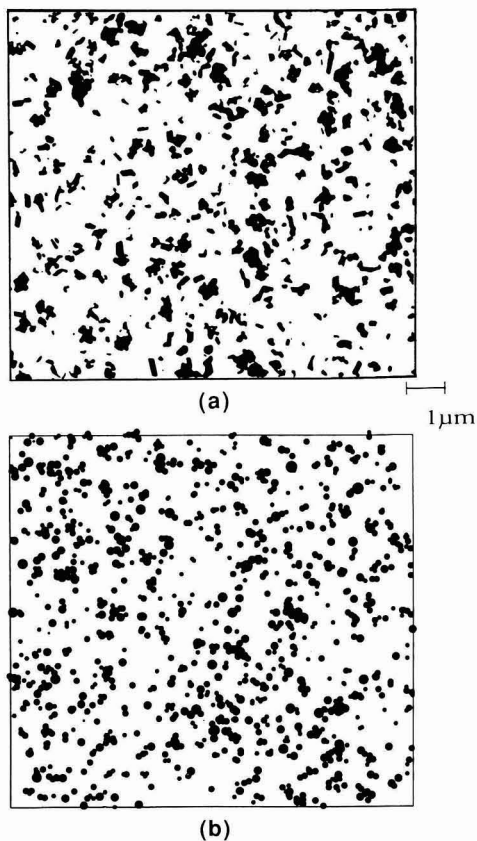
Figure 3—Comparison of actual (a) and simulated (b) TEMs of alkyd paint at 5% PVC. Data: f₁ = 0.3, weight mean size = 0.24 μm GSD = 1.3

(a)

⊢——⊣
1 μm

(b)
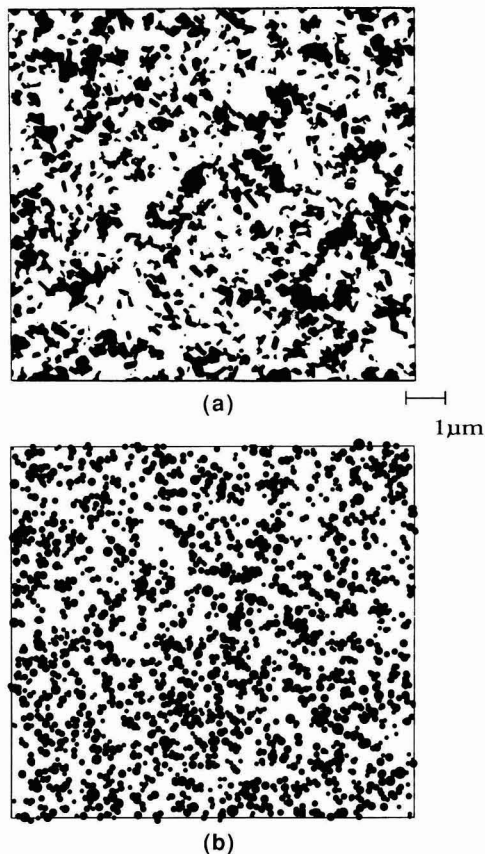
Figure 4—Comparison of actual (a) and simulated (b) TEMs of alkyd paint at 10% PVC. Data: f_1 = 0.3, weight mean size = 0.24 μm GSD = 1.3

CLUSTER DISTRIBUTION: This is also monitored on a continuous basis, simply by counting the clusters of a given number. The final distribution is produced as output from the program and may be compared with the theoretically exact form (calculated from a Smoluchowski distribution).

NEAREST NEIGHBOR DISTRIBUTION: The estimation of spatial distribution of near neighbors in the film is the main objective of this study. The light-scattering efficiency of pigments is dependent upon how well they are distributed within the medium.

Dispersion is assessed, for each constituent sphere, by calculating the distance the sphere is away from the nearest neighbor (NN) sphere (i.e., surface to surface distances), of the same type, and averaging over all the spheres. In addition to calculating the average distance of spheres from their NN, the model displays a description of the distribution of NN distance. This is done by counting those crystals with a NN closer than distance Δ, those

with NN distance between Δ and 2Δ, then 2Δ and 3Δ, etc. The value for Δ is chosen for a given simulation as:

$$\Delta = \frac{1}{30} (L_X \cdot L_Y \cdot L_Z / n)^{1/3} \qquad (18)$$

where n is the total number of crystals in the test volume, that is, Δ is the average inter-crystal distance divided by a suitable integer (a value of n = 30 was found to produce sufficient clusters in each interval).

The NN distances can also be calculated between clusters (i.e., particles) of the same type of sphere, with the average distance of particles from their NN and the distribution of NN distance being calculated in a similar way.

Application of the Model to Pigmented Paint Films

A typical packing plot obtained from the program is shown in *Figure* 2. For clarity, the sphere concentration used was only 1%. The sphere weight mean size and GSD

were 0.22 and 1.30 μm, respectively—these values are typical for commercial TiO_2 pigment crystals. The viewing angles can be readily changed to provide plots which may be compared with electron micrographs.

To validate the model, electron micrographs of simple alkyd paints were prepared and simulated using the program.

PREPARATION OF PAINT FILM ELECTRON MICROGRAPHS: A commercial TiO_2 pigment, with known crystal size distribution, was ball-milled in an alkyd medium and letdown in order to give PVCs of 5 and 10%. The resulting paints were drawn down onto glass slides for transmission electron microscopy (TEM). The fraction of single crystals present in each film was found by counting the number of singlets present in a 1,000-particle count from the TEM.

SIMULATION OF ELECTRON MICROGRAPHS: Input to the model consisted of weight mean crystal size and GSD, single crystal fraction (f_1), PVC, and the dimensions of the test volume. Although the actual thickness was not measured in this case, EM specimens made by the previously mentioned technique are normally about 1.0 μm in thickness but will contain a clear layer. It was found that a reasonable approximation to the EM image could be simulated by assuming that the thickness of the pigmented paint section was 0.6 μm. The computed plots are compared with the actual electron micrographs in *Figures* 3 and 4.

For both PVCs, the positions and sizes of the pigment clusters present in the TEMs appear to be well represented by the model. The results clearly show that random packing gives a good description of the pigment dispersion.

EFFECT OF TiO_2 CRYSTAL AND PARTICLE SIZE: The PVC was fixed at 20% and the program run using two different crystal sizes (0.26 and 0.20 μm). These two sizes represent approximate upper and lower limits for the mean crystal size of commercial TiO_2 grades. The GSD for each crystal size was set to a value of 1.3.

Figure 5 shows the effect of single crystal fraction on the crystal (sphere) and particle (sphere clusters) NN distances. The larger crystal size TiO_2 shows a clear spacing advantage (in terms of both crystal and particle NN distances) for a given f_1. As f_1 is raised, for a fixed crystal size, particle spacings decrease. The crystal spacings increase almost linearly with f_1.

Application of the Model to Extended Paint Systems

As mentioned in the Introduction, numerous articles have been written about the ability of extenders to act as diluents for pigments.[3,4,6-10] The addition of coarse extenders (size greater than TiO_2) reduces TiO_2 scattering efficiency and it has been suggested that crowding of TiO_2 is the cause, although the formation of a light-scattering "window" by large extenders has also been proposed.[10] Work by Cutrone[2] has suggested that pigmentary size extenders have a "neutral" effect on pigment dispersion and, therefore, paint opacity.

It was decided that the use of a packing model, to calculate the spacing of TiO_2 in the presence of extender, could therefore clarify and provide an explanation for the previously mentioned. Simulation could also help to predict and optimize the opacity of extended paint films.

Examination of alkyd paint films by electron microscopy showed that the flocculation pattern was predominantly separate for pigment and extender. This appeared to be the case for several types of extenders—clay, calcite, and blanc fixe. For the purpose of simulation, homoflocculation was therefore assumed to be the most appropriate model. In order to test both this supposition and the effect of extenders on TiO_2 dispersion, the program was run using various concentrations of TiO_2 and extender together with a range of extender sizes.

EFFECT OF EXTENDER SIZE FOR HOMOFLOCCULATED TiO_2 AND EXTENDER: The extender and TiO_2 volume concentrations were each fixed at 20% (giving a total PVC of 40%). A TiO_2 volume concentration of 20% represents the uppermost loading used in most applications. A TiO_2 crystal weight mean size of 0.22 μm was used and the single crystal fraction set at 0.2. The geometric standard deviation, for both pigment and extender crystal size, was fixed at 1.3. The simulation was repeated using extender crystal sizes between 0.1 and 1.0 μm. The mean crystal and particle NN distances, for pigment, are compared in *Figure* 6 and show a similar trend to each other. As extender size is reduced, pigment spacing (as measured by the crystal and particle mean NN distances) increases, most notably on decreasing extender size from 0.2 to 0.1 μm.

EFFECT OF TiO_2 VOLUME CONCENTRATION AND SINGLE CRYSTAL FRACTION (f_1): In order to model the effect of PVC, the TiO_2 and extender volume concentrations were each lowered to 13% (a PVC of 26% being similar to that found in a semi-gloss formulation). The calculations were
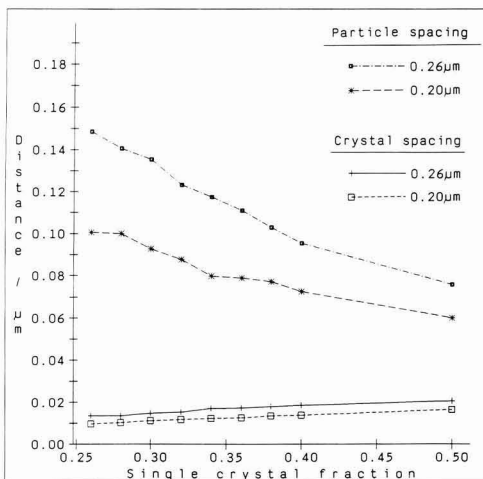
Figure 5—TiO_2 particle and crystal mean NN distances as a function of single crystal fraction and mean crystal size. Data: TiO_2 volume concentration = 20%, weight mean size GSD = 1.3
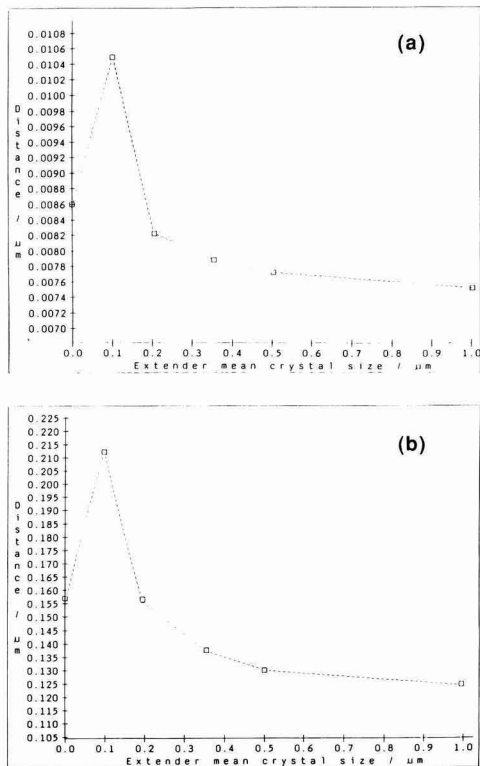
Figure 6—TiO₂ crystal (a) and particle (b) mean NN distances at 40% PVC. Data: TiO₂ volume concentration = 20%, f_1 = 0.2, weight mean size = 0.22 μm GSD = 1.3

repeated using a range of extender crystal sizes from 0.05 to 1.0 μm. Again, as was found at 40% PVC, a decrease in the extender size at 26% PVC produced an increase in TiO₂ pigment spacing (*Figure 7*). The most rapid increase in pigment spacing occurs for a decrease in extender size from 0.2 to 0.1 μm. The additional increase in pigment spacing by decreasing extender size to 0.05 μm is comparatively small. A further reduction in extender size produced a decrease in pigment spacing.

Pigment particle spacings, for a range of extender sizes, at single crystal fractions from 0.1 to 0.3 are shown in *Table* 1. The values of f_1 selected represent the range typically found for poorly and well dispersed paints, respectively. The results show that, for each f_1, particle spacings for small extenders (0.1 μm) are best. For example, at f_1 = 0.3 a decrease in extender mean size from 0.5 to 0.1 μm improves the TiO₂ particle mean NN distance by 0.107 μm.

EFFECT OF EXTENDER—TiO₂ RATIO: To assess the effect of extender content, at a fixed TiO₂ volume concentration, extender volume concentration was varied from 0 to 18%. The results (for a single crystal fraction of 0.2) are shown in *Figure* 8. For large and pigmentary size

extenders, increasing extender volume concentration produces a decrease in pigment spacing. In the case of a small extender (0.1 μm), an increase in extender volume concentration improves pigment spacing. For a 0.1 μm extender, the model predicts that increasing the extender volume concentration from 0 to 18% will raise the TiO₂ particle mean NN distance by about 29%.

EFFECT OF WEIGHT GSD: The widths of extender size distributions used in paints are often greater than found for pigment. The extender weight GSD was therefore varied between 1.3 and 2.0, using three different extender sizes (*Table* 2). The results show that, for large and pigmentary size extenders, increasing GSD improves pigment dispersion. For the small extender, changing the value of GSD from 1.3 to 1.7 produces an increase in pigment spacing. However, a further increase from 1.7 to 2.0 produces a slight decrease in spacing.

DISCUSSION

Simulation of paint film morphology using the packing model clearly demonstrates that random packing of pigment particles gives a good description of the state of dispersion. The results show that the Smoluchowski equation is suitable to describe the distribution of cluster sizes. Interestingly, comparison with the model shows that the positions of the clusters in the TEMs would appear to be generated in a random fashion.

Calculation of TiO₂ pigment particle spacing (*Figure* 5) shows the spacing advantage of using a large TiO₂ crystal size. For a given PVC and single crystal fraction (f_1), an increase in pigment particle spacing can increase scattering efficiency.[5] As PVC is raised, the spacing advantage of the large crystal size will improve, as has been verified by experiment.[5] However, it should be noted that light-scattering (opacity) is also a function of crystal size. For green light, Mie theory predicts that the light-scattering of rutile TiO₂ reaches an optimum for a mean crystal size near 0.23 μm. Therefore, to maximize opacity in, for example, a paint system, the spacing advantage of a large crystal size must compete with the better light-scattering of a small (0.23 μm) crystal size. For a given PVC and f_1, there will therefore be an optimum crystal size for TiO₂.

Application of the model to extended systems (*Tables* 1 and 2) produces significant differences in packing for extenders of different size. The effects of extender size on pigment packing have been long debated.[2-4,6-10] The

Table 2—Effect of the Width of Extender Size Distribution (GSD) on TiO₂ Particle Mean NN Distances at 13% TiO₂ Volume Concentration and 13% Extender Volume Concentration[a]

Extender Size/μm	f_1	GSD 1.3	1.7	2.0
0.5	0.2	0.177 (3)	0.194 (5)	0.214 (4)
0.2	0.2	0.211 (6)	0.226 (5)	0.254 (8)
0.1	0.2	0.280 (3)	0.300 (11)	0.256 (11)

(a) Standard errors of the mean NN distance are given in parentheses (for the least significant digits).

results from the model show that small extenders can produce the best pigment dispersion. An increase in TiO_2 pigment spacing should improve scattering efficiency, most notably at high PVC.

The increase in pigment NN distance with decreasing extender size is in line with predictions made by Cutrone,[14] using semi-empirical equations to derive scattering efficiency as a function of mean pigment surface distance (see Tunstall and Hird[5]). The equations derived by Tunstall and Hird also predict that optimum extender size decreases as PVC is raised.

At 13% TiO_2 volume concentration and 13% extender volume concentration, with $f_1 = 0.2$, the optimum extender crystal size for maximum TiO_2 particle spacing is ca. 0.05 μm (*Figure 7*). Smaller extenders produced a decrease in pigment spacing. For an extender mean crystal size of 0.05 μm with $f_1 = 0.2$, the corresponding extender particle size is 0.08 μm (assuming Smoluchowski aggregation).

To quantify the relationship between particle spacing and scattering efficiency, TiO_2 particle mean spacings calculated from the current model were used to fit experimental data to the form of equation (19) (which was derived by Tunstall and Hird[5]). This enabled the constants A and B to be determined.

$$S/S_o = 1 - (A/f) \exp(-Bc) \qquad (19)$$

where:
S/S_o = backscattering efficiency[5]
A,B = constants
f = pigment volume fraction
c = particle mean spacing

Values of S/S_o calculated using equation (19), at 13% TiO_2 and 13% extender volume concentration, are shown in *Table 3*. It can be seen that a reduction in extender mean size from 1.0 to 0.1 μm produces a 7% increase in backscattering efficiency calculations at 20% TiO_2 volume concentration and 20% extender volume concentration (*Table 4*) showed that the corresponding increase would be ca. 17%, illustrating that the size of extender becomes more critical as TiO_2 volume concentration is raised.[5] Interestingly, at 26% PVC a further decrease in extender size from 0.1 to 0.05 μm does not produce a significant increase in S/S_o.

The results for large and pigmentary size extenders also show that increasing GSD (*Table 2*) produces a larger number of fine particles which improve pigment dispersion. However, for small extenders which are already near the optimum size (i.e., near 0.08 μm), increasing GSD has a varied effect on the dispersion of pigment. For a 0.1 μm crystal size extender, increasing GSD from 1.3 to 1.7 improves pigment spacing. However, as GSD for 0.1 μm crystals is further increased, then pigment spacing decreases. Clearly, for a crystal size and GSD of 0.1 and 2.0 μm, respectively, an excess of small crystals below the optimum size is produced. Also of note is that for a GSD of 2.0 the difference in TiO_2 particle spacing between small and large extender mean sizes is much less than found for a GSD of 1.3. Therefore, as the width of extender size distribution increases, mean extender size becomes less important with respect to TiO_2 spacing.
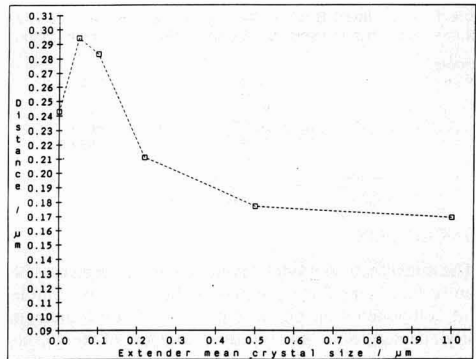
Figure 7—TiO_2 particle mean NN distances as a function of extender weight mean size. Data: TiO_2 volume concentration = 13%, f_1 = 0.2, weight mean size = 0.22 μm GSD = 1.3. Extender volume concentration = 13%, f_1 = 0.2, weight mean size GSD = 1.3

Table 3—Calculated Backscattering Efficiencies at 13% TiO_2 Volume Concentration and 13% Extender Volume Concentration

Extender Size/μm	c/μm	S/S_o
1.0	0.170	0.936
0.5	0.177	0.948
0.2	0.211	0.981
0.1	0.280	0.998
0.05	0.294	0.998
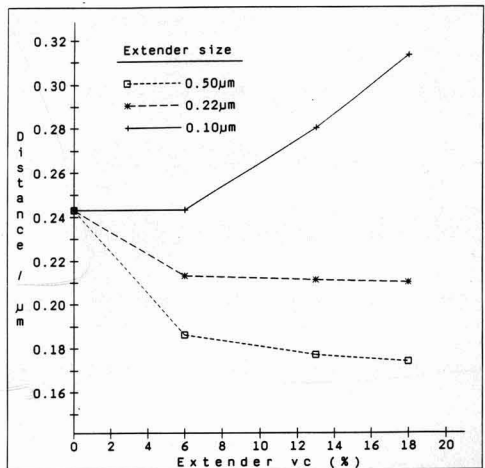
Figure 8—TiO_2 particle mean NN distances as a function of extender volume concentration and size. Data: TiO_2 volume concentration = 13%, f_1 = 0.2, weight mean size = 0.22 μm GSD = 1.3. Extender f_1 = 0.2, weight mean size GSD = 1.3

Table 4—Calculated Backscattering Efficiencies at 20% TiO₂ Volume Concentration and 20% Extender Volume Concentration

Extender Size/μm	c/μm	S/S_o
1.0....................	0.125	0.842
0.5....................	0.131	0.868
0.2....................	0.157	0.939
0.1....................	0.212	0.988

CONCLUSION

The mathematical model developed would appear to be a powerful method for predicting the effect of simple paint components on pigment packing. The program is easily adapted to include multiple components (e.g., latex particles, several types of extender, and air voids).

The technique may be used to help resolve the debate over the role of extenders as pigment "diluents." The effect of extenders on pigment crowding and resulting film opacity can therefore be considered. The results suggest that the use of smaller particle size extenders can produce less pigment crowding. This is in agreement with previous experimental data[2] and predictions from earlier models based on cubic packing.[9]

The model can be used to improve TiO₂ pigment spacing by predicting the optimum extender size distribution and concentration for a given formulation. An improvement in TiO₂ spacing should improve its scattering efficiency and therefore utilization.

Future developments will include studying the effects of latex on pigment dispersion. Modification of the program to include particle shape effects will also be considered.

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Effect of Plasma Treatment of Titanium Dioxide and Quinacridone Red Pigments on Dispersion Behavior In Water-Soluble Acrylic Resins

Toshikatsu Kobayashi, Hiroyuki Kageyama, Kenji Kouguchi, and Shouji Ikeda
Nippon Paint Company, Ltd.*

Surface modification of quinacridone red and TiO_2 pigments was carried out using a low temperature plasma method. Quinacridone red was treated with NH_3 plasma, and TiO_2 was treated with styrene and octafluorocycrobutane plasmas.

The dispersion behavior of such plasma-treated pigments in water-soluble acrylic resins was studied and correlated to the hydrophilicity (hydrophile property) of the pigments. The degree of hydrophilicity was evaluated by measuring the heat of immersion in water.

It was found that the most favorable hydrophilicity values for pigment dispersion in water-soluble acrylic resin was around 0.25 J/m^2 by the heat of immersion in water.

INTRODUCTION

A waterborne paint is a preferable material for a nonpolluting coating system, and already is used widely, for example, in trade sales or electrodeposition paint. In addition, waterborne automotive topcoats have recently been developed.

There is a fundamental problem of pigment dispersion in such paint manufacturing. The DLVO theory[1,2] has been successfully applied to the stabilizing mechanism of colloidal systems. However, the ionic strength in resin solutions of waterborne paint systems is much higher than in the systems to which DLVO theory has been applied.

Stabilization by electrostatic repulsion between pigment particles in such waterborne paints seems to be difficult.

In our previous study on pigment dispersion in water-soluble resins, the following conclusions were reported[3,4]:

(1) In the dispersion of hydrophilic pigment [such as titanium dioxide (TiO_2)], the wetting of such pigment by the water solution of resins was easily attained. However, the stabilization, which was given by the adsorption of dispersing resin on the pigment surface, was the rate determining process, or the bottleneck of dispersion of hydrophilic pigment. A certain degree of hydrophobicity given to the hydrophilic pigment surface increased the amount of resin adsorption on the pigment, and finely dispersible pigment was obtained.
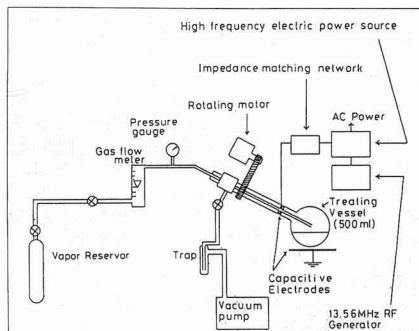
Figure 1—Treating apparatus for styrene and cyclo-C_4F_8 plasma treatment
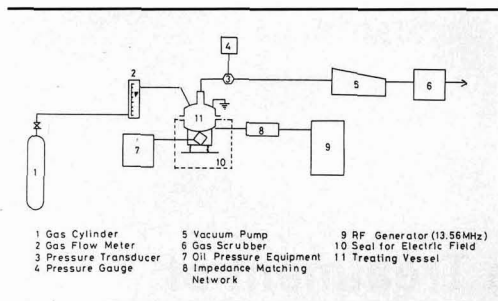
Figure 2—Apparatus for NH₃-plasma treatment

1 Gas Cylinder   5 Vacuum Pump   9 RF Generator (13.56MHz)
2 Gas Flow Meter   6 Gas Scrubber   10 Seal for Electric Field
3 Pressure Transducer 7 Oil Pressure Equipment 11 Treating Vessel
4 Pressure Gauge   8 Impedance Matching
                          Network

(2) On the other hand, for hydrophobic pigments [such as quinacridone red (QR) pigment] the wetting process was the bottleneck of the dispersion. Therefore, in order to finely disperse hydrophobic pigment in the water-soluble resin, a certain degree of hydrophilicity had to be given to the pigment surface.

(3) From these results, we can conclude there is a suitable hydrophilicity value of pigment surface for the fine pigment dispersion in water-soluble paint.

A surface treating technique using low temperature plasmas has been developed recently. Organic compounds, such as aromatic and olefin hydrocarbons and alicyclic compounds, give plasma-polymerized films on various substrates, and surface properties of the substrates are modified.[5] Ihara et al.[6] reported that hydrophobicity of carbon black and organic pigments was reduced by plasma treatment using nonpolymer-forming gas, such as ammonia, oxygen, and nitrogen.

In this study, we modified the hydrophilicity values of the pigment surfaces of TiO_2 by styrene and octafluorocyclobutane (cyclo-C_4F_8) plasmas and QR by ammonia (NH_3) plasma.

It was found that the most finely dispersible pigments in water-soluble acrylic paint could be obtained by adjusting the hydrophilicity value of the pigment to around $0.25 J/m^2$, measured by the heat of immersion in water.

EXPERIMENTAL

Plasma Surface Treating Apparatus for Styrene and Cyclo-C₄F₈ Plasma Treatment

The schematic diagram of the apparatus used for styrene and cyclo-C_4F_8 plasma treatment of TiO_2 pigment is shown in *Figure* 1. Radio frequency (RF) power (13.56 MHz) was applied through the impedance matching network to one of capacitive electrodes. The other electrode was grounded.

The treating vessel (500 mL) containing pigment was rotated at 30 rpm. The vessel was reduced to a base pressure of 10 Pa. by a vacuum pump. Then styrene or cyclo-C_4F_8 was supplied from the reservoir and the pressure was increased to the levels determined for each experiment. The gas flow meter and pressure gauge were placed in the circuit in order to adjust the experimental conditions.
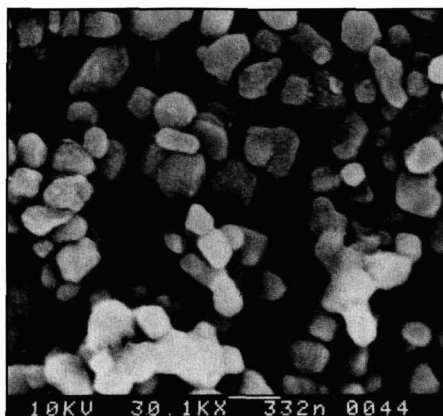
(a)
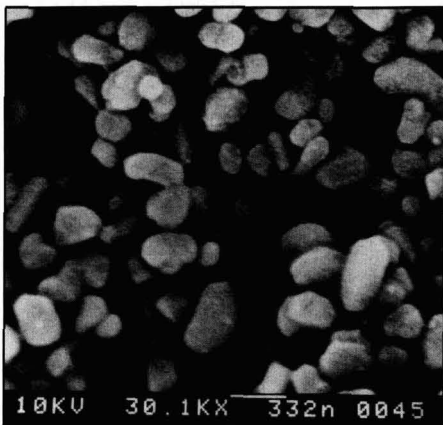
(b)
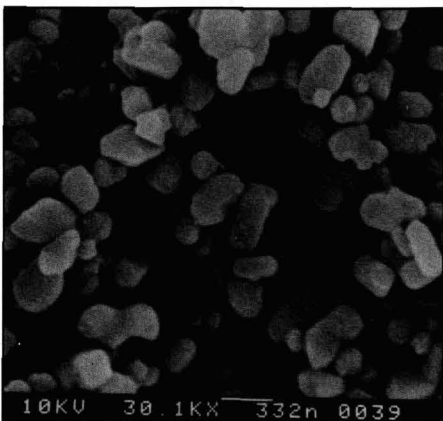
(c)

Figure 3—SEM photographs of TiO₂ treated by styrene and cyclo-C₄F₈ plasmas (30,000 X)
(a) Non-treatment
(b) Styrene (60W, 0.6 Torr, 15 min)
(c) Cyclo-C₄F₈ (50 W, 0.5 Torr, 5 min)

Styrene (60W, 0.6Torr, 15min)
Cyclo-C$_4$F$_8$ (50W, 0.5Torr, 5min)

Binding Energy (eV)
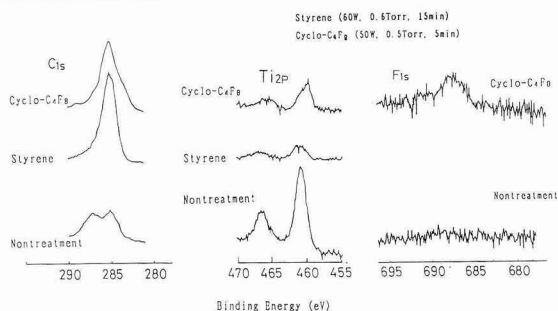
Figure 4—XPS spectra of TiO$_2$ treated by styrene and cyclo-C$_4$F$_8$ plasmas

Plasma Surface Treating Apparatus for NH$_3$ Plasma Treatment

The schematic diagram of the apparatus used for NH$_3$ plasma treatment of QR is shown in *Figure* 2. RF power (13.56 MHz) was applied through the impedance matching network to the lower part of a 45 L treating vessel. The upper part of the vessel was isolated electrically from the lower part and grounded.

The vessel containing 2.5 kg of pigment was pumped down to a base pressure of 20 Pa. by a vacuum pump. Then, NH$_3$ was allowed to flow in and the pressure was increased to 100 Pa.

Plasma was generated inside the vessel, which was vibrated by the oil pressure equipment.

Pigments

Two kinds of titanium dioxide (TiO$_2$-A and TiO$_2$-B) [commercial grade, rutile type] and quinacridone red
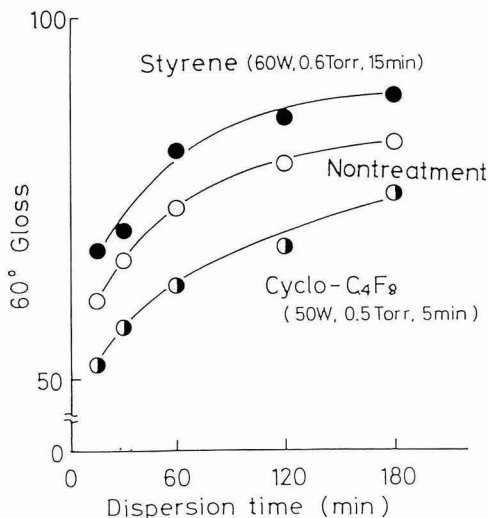
Figure 5—Dispersion rate of TiO$_2$ treated by styrene and cyclo-C$_4$F$_8$ plasmas
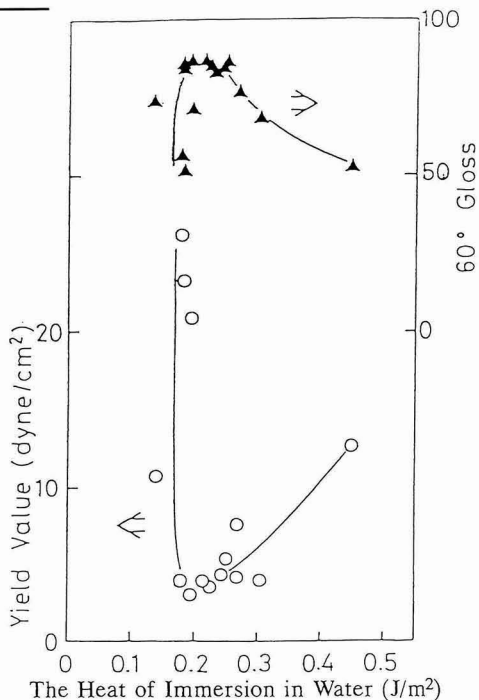
Figure 6—Dispersion efficiency of TiO$_2$ pigments treated by styrene and cyclo-C$_4$F$_8$ plasmas

Table 1—Water Soluble Acrylic Resins Used in Experiments

Ser. No.	Monomer Contents (wt%)					Acid Value	Mn[f]	SP
	MAA[a]	MMA[b]	LMA[c]	EA[d]	HEA[e]			
WD-1....	9.2	25.3	5.5	30.0	30.0	60	6200	12.5
WD-2....	9.2	24.0	21.9	30.0	15.0	60	6400	11.5
WD-3....	9.2	11.6	44.2	30.0	5.0	60	6400	10.5

(a) Methacrylic acid.
(b) Methyl methacrylate.
(c) Laulic methacrylate.
(d) Ethyl acrylate.
(e) Hydroxyethyl acrylate.
(f) Number averaged molecular weight measured by GPC (Polystyrene standards).

Table 2—Dispersing Formulations and Conditions

Formulations	Acrylic resin	6.7	22.0
	Butyl cellosolve	6.6	19.0
	Water	41.7	41.0
	DMEA	0.76	2.3
	TiO_2	45.0	—
	QR	—	18.0
(g) .... Total		100.76	102.3
Dispersing			
conditions	Rotation speed (rpm)	1000	2000
	Dispersion time (hr)	3	5

Table 3—Surface Characteristics of TiO_2-A Treated by Styrene and Cyclo-C_4F_8 Plasmas

Titanium Dioxide	Nontreatment (TiO_2-A)	Styrene-Plasma (60W, 0.6 Torr, 15 min)	OFCB-Plasma (50W, 0.5 Torr 5 min)
Amount of adsorbed resin ... (mg/m^2)	8	15	5
Heat of immersion .... (J/m^2)	0.28	0.23	0.15
Specific surface area .... (m^2/g)	10.5	9.5	9.8

[Cinquasia Red Y RT-759D, CIBA-GEIGY] were selected. Those are typical of a hydrophilic and a hydrophobic pigment, respectively, among the pigments which are widely used in automobile topcoats. The surface of TiO_2-A was treated by alumina and the surface of TiO_2-B was treated by silica and alumina.

Resins

A series of acrylic resins was synthesized by a conventional method changing the hydrophilicity. The hydrophilicity of each resin was evaluated by measuring the solubility parameter by turbidometric titration.[7] Monomer contents and other characteristics of each resin are listed in *Table* 1. The acrylic resins were dissolved in water by neutralizing the carboxyl group of the resins with dimethyl ethanol amine (DMEA). The molar ratio of DMEA to the carboxyl group was 1.1:1 and the pH value of the resin solutions was approximately 9. Each resin gave a clear solution.

Measurement of the Heat of Immersion

The heat of immersion of pigment in water was measured by a twin isoperibol calorimeter (TIC-221, Tokyo Ricoh Co., Ltd.) for the quantitative evaluation of the degree of hydrophilicity of the pigment surface. The measurement procedure was as follows.

Pigment was placed in a glass ampoule so that the surface area of pigment in it was $10 \sim 15$ m^2. The glass ampoule was evacuated until the inner pressure reached 10^{-4} Torr by vacuum pump and then sealed. The sealed glass ampoule containing pigment was set in the Dewar's vessel in the calorimeter and 100 mL of deionized water was added to the vessel. After the temperature of the vessel reached a constant value (35°C), the glass ampoule was broken and the pigment inside was immersed in the water. The evolved heat of immersion was evaluated by measuring the temperature increase using a thermocouple and the heat of immersion per unit surface area of the pigment was calculated. The specific surface area of each pigment was measured by BET method using BELSORP 28 gas adsorption apparatus (BEL JLAPAN INC.)

Procedure of Pigment Dispersion

The dispersion mill used for this experiment was reported on previously.[8] The dispersing temperature was 20°C and other dispersing conditions and pigment paste formulations are shown in *Table* 2.

Evaluation of the Dispersibility of Pigment

The dispersibility (or the degree of flocculation) of pigment in the resin solution was evaluated by the measurement of the yield value. Shear stress at various shear rate, ranging from 1.92 sec^{-1} to 384 sec^{-1}, was measured by a cone-plate type viscometer (E Type Viscometer, Tokyo Keiki Co., Ltd.). The temperature was kept at 25°C. The yield value was calculated from the Cas-

Table 4—Characteristics of Plasma-Treated TiO_2 Pigments and Their Dispersed Pastes

Titanium Dioxide	Monomer	Conditions for Plasma Treatment			Specific Surface Area (m^2/g)	Heat of Immersion (J/m^2)	Characteristics of Dispersed Paste	
		Power (W)	Pressure (Torr)	Time (min.)			60° Gloss	Yield Value ($dyne/cm^2$)
A		Non-Treatment			12	0.27	74	7.5
A	OFCB[a]	50	0.5	5	10	0.14	73	10.7
A	OFCB	50	1.0	30	10	0.18	56	26.4
A	OFCB	50	0.5	30	10	0.19	51	23.2
A	OFCB	50	0.5	5	11	0.20	71	20.9
A	OFCB	50	0.5	1	12	0.23	85	3.6
A	ST[b]	60	1.0	15	9	0.18	83	4.0
A	ST	60	0.6	15	11	0.19	86	3.0
A	ST	60	1.0	5	9	0.22	86	3.9
A	ST	60	1.0	15	9	0.25	82	4.2
A	ST	60	1.0	30	9	0.25	86	5.3
B		Non-Treatment			8	0.45	52	12.5
B	ST	100	1.0	30	8	0.30	68	3.9

(a) OFCB—Octafluorocyclobutane.
(b) ST—Styrene.

son's plot.[9] The plot of shear stress vs shear rate of the pigment dispersed paste in this study followed the Casson's equation quite well.

Evaluation of the Degree of Dispersion

The degree of pigment dispersion was evaluated by measuring the gloss of paint film on a glass plate.

Measurement of Adsorbed Resin Amount

The amount of adsorbed resin on pigment was measured by the gravimetric method, using a centrifugal separator. Centrifugal separation of pigment with adsorbed resin, after dilution of DMEA/acetic acid solution, was repeated until its weight reached a constant value. The amount of adsorbed resin was calculated by subtracting the pigment weight.

RESULTS AND DISCUSSION

SEM and XPS Analysis of Styrene and Cyclo-C₄F₈ Plasma-Treated TiO₂ Pigment

Figure 3 shows the Scanning Electron Microscope (SEM) photographs of TiO₂-A pigment treated by styrene and cyclo-C₄F₈ plasma, along with that of untreated TiO₂-A pigment. Formation of large TiO₂ particles or pure polymeric particles was not observed.

Figure 4 shows the X-ray Photoelectron Spectroscopy (XPS) spectra of such treated TiO₂-A pigments. The intensity of the C1s spectrum increased while that of the Ti2p spectrum decreased in both styrene and cyclo-C₄F₈ plasma treatments. F1s spectra show that the F atom was introduced by the cyclo-C₄F₈ plasma treatment.

From these observations, we considered that plasma-polymerized films of styrene or cyclo-C₄F₈ were deposited on each TiO₂-A pigment particle.

Heat of Immersion of Styrene and Cyclo-C₄F₈ Plasma-Treated TiO₂ Pigment

The heat of immersion value of TiO₂-A sample in water is shown in *Table* 3. Both styrene plasma and cyclo-C₄F₈ plasma treatments of TiO₂-A pigment increase the hydrophobicity (decrease the hydrophilicity). The hydrophobicity was increased more by the cyclo-C₄F₈ plasma than by the styrene plasma at these treatment conditions.

Dispersion Behavior of Styrene and Cyclo-C₄F₈ Plasma Treated TiO₂ Pigment

The dispersion behavior of those plasma treated TiO₂-A pigments is shown as the increase of gloss of dispersed paste against dispersion time. The dispersing resin was WD-1 in *Table* 1. The dispersion rate was increased by styrene plasma treatment. However, it was decreased by cyclo-C₄F₈ plasma treatment (*Figure* 5). The amount of adsorbed resin on TiO₂ pigment in those dispersed pastes is also shown in *Table* 3. It was increased by styrene plasma and decreased by cyclo-C₄F₈ plasma treatment.

These effects are based on the change of hydrophilicity of the pigment surface, by styrene plasma treatment, i.e., the surface was turned into an appropriately hydrophobic
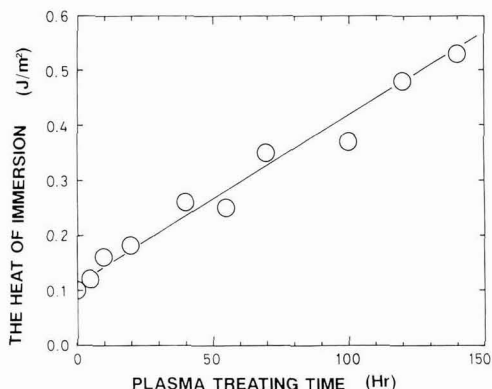
Figure 7—Effects of NH₃-plasma treating time on the heat of immersion of QR

surface as the stabilization of dispersion by resin adsorption (through the hydrophobic interaction) was enhanced and the wetting by the aqueous resin solution was not disturbed. On the other hand, by cyclo-C₄F₈ plasma treatment, the surface was changed to be more hydrophobic, which interfered with the wetting. A lower degree of wetting resulted in less amount of adsorbed resin per unit area of pigment which had been determined for dry pigment by the BET method.

Two kinds of TiO₂ pigment (TiO₂-A and TiO₂-B) were treated by styrene and cyclo-C₄F₈ plasma changing treatment conditions such as power, pressure, and treatment time.
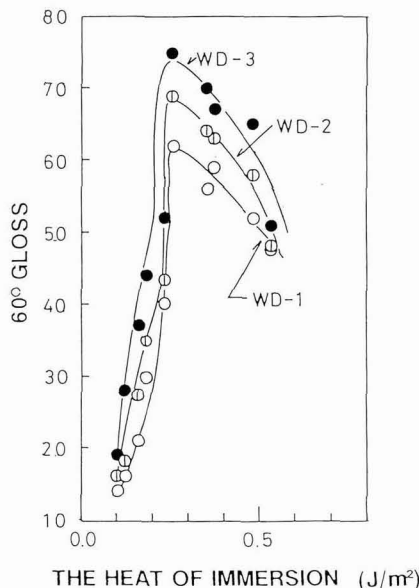
Figure 8—Effects of hydrophilicity of dispersing resin and QR (treated by NH₃-plasma) on the gloss of dispersed paste
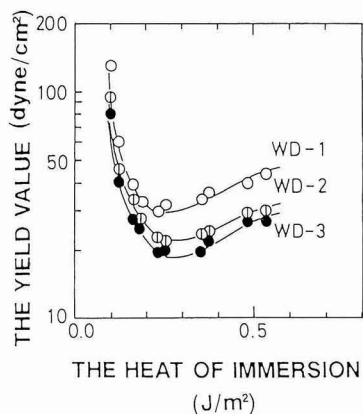
Figure 9—Effects of hydrophilicity of dispersing resin and QR (treated by NH_3-plasma) on the yield value of the dispersed paste

Surface characteristics of such treated TiO_2 pigments are shown in *Table* 4 along with the treatment conditions and the properties of the dispersed pastes. The relationships between the heat of immersion of those treated TiO_2 pigments and the gloss and the yield value of the dispersed pastes are shown in *Figure* 6.

As the heat of immersion decreased, the gloss increased, reached a maximum value at the heat of immersion value of $0.2 \sim 0.25$ J/m^2, and then decreased. On the other hand, as the heat of immersion decreased, the yield value of the pigment dispersed pastes decreased, reached a minimum at the heat of immersion value of $0.2 \sim 0.25$ J/m^2, and then increased. From these results, the existence of optimum hydrophilicity (or hydrophobicity) value of pigment surface, as had been expected in our previous study,[3] was experimentally confirmed.

Heat of Immersion of NH_3 Plasma Treated QR

Figure 7 shows that the heat of immersion of QR increased as NH_3-plasma treatment time increased and reached 0.53 J/m^2 after 140 hours.

We have reported that basic groups containing nitrogen are incorporated on the QR surface by NH_3 plasma treatment.[10] This increase of the heat of immersion was thought to be due to incorporation of hydrophilic (basic) functional groups onto QR surface.

Dispersion Behavior of NH_3-Plasma Treated QR

Those NH_3-plasma-treated QR pigments were dispersed in water-soluble acrylic resins of different hydrophilicity (*Table* 2). The gloss and the yield value of the dispersed pastes were evaluated after five hours' dispersion and plotted against the heat of immersion value in *Figure* 8 and *Figure* 9, respectively.

Similar tendencies were observed in the dispersion behavior of NH_3-plasma-treated QR compared with that of styrene and cyclo-C_4F_8 plasma-treated TiO_2 pigment, that is, in *Figure* 8, there is a maximum value in the gloss of paint film, and in *Figure* 9, a minimum in the yield

value of the pigment dispersed pastes, both at the heat of immersion value of 0.25 J/m^2.

These data were also observed by using other resins, which were different in hydrophobicity (or hydrophilicity). Higher gloss of the paint film and lower yield value of dispersed paste were obtained by using more hydrophobic dispersing resin. This result can be explained by the enhanced dispersion stability which is attained by the adsorption of resin through hydrophobic interaction between the resin and pigment.

CONCLUSION

Surface modification of TiO_2 and quinacridone red pigments was carried out using a low temperature plasma method to change the hydrophilicity (hydrophobicity) of the pigment surface. TiO_2 (hydrophilic) pigments were treated with styrene and cyclo-C_4F_8 plasmas to decrease hydrophilicity and QR (hydrophobic) pigment was treated with NH_3-plasma to increase hydrophilicity. The degree of hydrophilicity was evaluated by measuring the heat of immersion in water.

The dispersion behavior of such plasma-treated pigments in water-soluble acrylic resins of different hydrophilicity (evaluated by solubility parameter) was studied and correlated to hydrophilicity of the pigments and resins.

It was found that the most favorable hydrophilicity values of pigment, where a maximum gloss and a minimum yield value of pigment dispersed paste was obtained, was around 0.25 J/m^2 which is estimated by the heat of immersion. Higher gloss and lower yield value of the dispersed paste were obtained by using the resin of lower hydrophilicity (higher hydrophobicity) for a pigment of any hydrophilicity.

From these results, we confirmed that there is the optimum hydrophilicity value of the pigment surface for the excellent dispersion, where both the wetting by the aqueous resin solution and the stabilization by the resin adsorption through the hydrophobic interaction between the resin and pigment were adequately achieved.

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High Solids Polyorganosiloxane Polymers For High Temperature Applications

William A. Finzel
Dow Corning Corporation*

Polyorganosiloxane (silicone) resins have historically been available for high temperature applications at relatively low nonvolatile content. Since no one silicone resin is available that fulfills all customer performance properties, a family of resins has been developed that by themselves or blended with other silicone or organic resins can best meet customer needs. Unique processing techniques and cure chemistry have resulted in higher nonvolatile content silicone resins that achieve desired film performance. Three silicone resins will be described that represent soft, medium hard, and hard resins all with low volatile compound (VOC) content. The paper will describe solution and paint film properties of the higher nonvolatile content resins and compare these properties with conventional silicone resins.

INTRODUCTION

The first commercially available polyorganosiloxane or silicone resin for high temperature application was developed in 1934 for improving the heat resistance of glass-fiber tapes used in electric motors.[1] Silicone resins development after World War II made possible hundreds of coating formulations that can withstand to high temperature service.

Silicone resins can be used by themselves, or blended with other silicone or organic resins, to meet the specific needs of the application. High temperature service is usually defined as 250°F to 1400°F. Pigment selection as well as silicone resin type is critical to meet temperature

requirements. Several temperature categories can be defined based on silicone resin, organic resin content, and pigment type[2] which can determine the best coating system for each application. Many popular silicone resins are supplied in aromatic solvents at 50% solids and have weight average molecular weights from 400,000 to 500,000. Lower molecular weight silicone resins have been limited to lower temperature applications or used in blends with organic resins because of better compatibility.

Volatile organic compound (VOC) content of protective coatings has been reduced in recent years, and VOC reductions will be increased and regulations enforced. Even though silicone and silicone organic high temperature protective coatings are considered specialty coatings, they are being regulated. Current California regulations for high temperature coatings (1000°F) are currently 6.0 lb/gal VOC and are scheduled to be reduced to 3.5 lb/gal in 1994. Heat resistant coatings (400°F) are currently 3.5 lb/gal VOC and could go to 2.5 lb/gal by 1994.

Solvent content must be reduced in many of the existing high temperature paint formulations to conform to existing or future pollution regulations. Alternative resin products will have to be high solids, solventless, or water based.

Polyorganosiloxane polymers, like organic polymers, are capable of being designed as low molecular weight oligomers capable of crosslinking through reactive sites to form higher molecular weight polymers. Water-based silicones and organic-modified silicone copolymers are possible as soluble, dispersed, or emulsions, and although some products are available, they will not be discussed in this paper.

The objective of this paper is to evaluate three high solids polyorganosiloxane polymers in high temperature low VOC paints and compare the performance properties of these resins with commercially available high temperature paint binders.

Table 1—Resin Properties

Resin	NVM[a]	Viscosity (cP)	Functionality	
Low VOC				
A (soft)	80	200	SiOH	(3%)
B (hard)	90	55	SiOH	(2%)
			SiOMe	(15%)
C (hard)	80	700	SiOH	(3%)
High VOC				
D (soft)	50	125	SiOH	(1%)
E (hard)	50	125	SiOH	(1%)

(a) Nonvolatile material.

Table 2—Aluminum Paint

Formulation
50.0   Leafing aluminum paste (65%)
50.0   Silicone resin solids
‾‾‾‾‾
100.0

Viscosity reduction
30 sec No. 2 Zahn Cup
Solvent — Xylene

Table 3—Aluminum Paint

Resin	NVM (D-2369)	lb/gal (D-1475)	VOC[a]
Low VOC			
A (soft)	58	9.1	3.8/455
B (hard)	60	9.3	3.8/455
High VOC			
D (soft)	39	8.7	5.3/635
E (hard)	41	8.7	5.1/611

(a) EPA Reference Method 24 (lb/gal/g/L).

Table 4—Aluminum Paint[a]

Resin	Hardness (D-3363)	Adhesion (D-3359)	Solvent Resistance[b] MEK	Toluene
Low VOC				
A (soft)	2H	100	45	60
B (hard)	5H	100	56	90
High VOC				
D (soft)	2H	100	50	50
E (hard)	2H	100	32	52

(a) Cold-rolled steel panels (.032) — cured 30 min 450°F.
(b) Double rubs with cheese cloth covered 20 oz ball peen hammer.

CHLOROSILANES

Silicones are made from organo-substituted chlorosilanes, which are prepared from elemental silicon. A metallurgical grade of silicon formed by the reduction of silica with carbon is used.

$$SiO_2 + 2C \xrightarrow{>1420°C} Si + 2CO$$
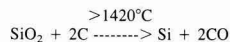
Silicon is usually converted to organo-substituted chlorosilanes by reaction with alkyl or aryl halides in a direct process developed by Rochow.[3] This reaction is especially important in manufacturing methylchlorosilanes in the presence of copper catalyst.

$$Si + MeCl \xrightarrow[>300°C]{Cu} MeSiCl_3 + Me_2SiCl_2 + Me_3SiCl \text{ (plus other minor products)}$$

Silver is sometimes employed in the direct process for phenylchlorosilanes from silicon and phenylchloride.

Phenylmethyldichlorosilanes and a wide variety of more specialized monomers are made by Grignard alkylation. The silicone industry was the first to employ this reaction on an extensive commercial scale and it is still widely used today.

$$MeSiCl_3 + PhMgCl \xrightarrow{ether} MePhSiCl_2 + MgCl_2$$
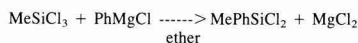
A complete discussion of the chemistry of chlorosilanes is found in *Chemistry and Technology of Silicones*.[4]

POLYORGANOSILOXANES

Chlorosilanes are readily hydrolyzed by water to form silanols and hydrogen chloride. Silanols react further with the elimination of water to form siloxanes. *Silicone* is a generic term including substances constituted of alternating silicon and oxygen atoms in which most of the silicons are also linked to at least one monofunctional organic radical through stable carbon-silicon bonds.

The final product of hydrolysis of monochlorosilanes are disiloxanes such as hexamethyldisiloxane:

$$2Me_3SiCl + H_2O \longrightarrow Me_3SiOSiMe_3 + 2HCl$$

Dichlorosilanes give siloxanes:

$$R_2SiCl_2 + n H_2O \longrightarrow R_2SiO + 2 HCl$$

Hydrolysis of trichlorosilanes results in silsesquioxanes, although this term is usually reserved for completely condensed cubical octomers and similar structures:

$$RSiCl_3 + 3/2 H_2O \longrightarrow RSiO_{3/2} + 3 HCl$$

The process for the preparation and cure of polyorganosiloxane resins consists of first the formation and then the condensation of silanol groups.

$$SiCl + H_2O \longrightarrow SiOH + HCl \text{ (reaction 1)}$$
$$SiOH + HOSi \longrightarrow SiOSi + H_2O \text{ (reaction 2)}$$

Mixtures of chlorosilanes are dissolved in sufficient toluene or xylene to give a 30-50% silicone resin solution after hydrolysis. This solution is mixed with enough water to yield 17% hydrochloric acid. Hydrolysis is rapid at room temperature, but the water may be warmed to 70°C to modify the nature of the hydrolysis products. Simulta-

neously, the more reactive silanol groups condense to begin the formation of siloxane structures.

The organic layer is separated from the hydrochloric acid layer and washed with water (sometimes a bicarbonate solution) to obtain an acid-free product. The solvent may be completely or partially removed by stripping at 90-150°C under reduced pressure. At this point the resin contains 3 to 6 wt% silanol (calculated as hydroxyl) and has a solution viscosity (60% toluene) of about 20 cP.

The molecular weight can be increased to improve coating properties and physical strength. Again, this involves condensation (reaction 2), but the residual silanols are less reactive. Azeotropic removal of water, sometimes catalyzed by metallic salts, is performed on the 50-90% solids solution. The finished resin contains 0.5-1.2% OH and may have a 50% viscosity of 150 cP.

Major applications for silicones in coatings are based on their thermal stability and their resistance to outdoor weathering. These properties are proportional to the percent silicone in silicone organic copolymers and cold blends.

Thermal stability in air is related to the fact that the silicone polymer backbone is completely oxidized, and is, therefore, not subject to oxidative degradation. Ultimate oxidative degradation of silicones involves the removal of organic substituents by oxidation of the silicon-carbon bond:

$$Si–C + O_2 ----> SiO + CO$$
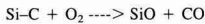
The useful half-life of a silicone coating may be defined as the time at elevated temperature at which half of the organic groups are removed from silicon. This varies widely with different groups on silicon, with phenyl being the most resistant to oxidation.

HIGH SOLIDS POLYORGANOSILOXANE POLYMERS

Two methods to increase nonvolatile or solids content are illustrated in the current study. The first is to hydrolyze phenylmethylchlorosilanes in organic solvent and partially condense the silanols to form a partial hydrolyzate. The reactive silanol groups will further condense on curing with the aid, if necessary, of a metal catalyst such as zinc, cobalt, or iron octoate. Examples are Resins A and C shown in *Table* 1. Resin A contains more difunctional siloxanes than Resin C and is therefore lower in viscosity and results in softer and more flexible cured coatings.

The second method involves alkoxy functional silanes and polyorganosiloxanes that react with silanol functional polyorganosiloxanes catalyzed by titanates and heat. Resin B contains both methoxy and silanol functionality. The product is solventless but is considered 90% nonvolatile since methanol is released when heat cured or tested for nonvolatile content.

Two high VOC resins (D and E) are also shown in *Table* 1. They are both zinc-bodied, high molecular polyorganosiloxane resins that exhibit excellent heat resistance. High and low solids polyorganosiloxane resins were tested in aluminum and white paints. Paints were

Table 5—Aluminum Paint Heat Resistance[a] (1000°F)

Resin	Condition (hr)		
	100	250	500
Low VOC			
A (soft)	10	10	8
B (hard)	10	10	9
High VOC			
D (soft)	10	10	9
E (hard)	10	10	8

Key: 10 = no failure; 9 = trace failure; and 8 = 1-5% failure.
(a) Cold-rolled steel (12 gauge) (sandblasted).

Table 6—White Paint

Formulation
45.0 Rutile TiO_2
10.0 Mica C-1000
45.0 Resin solids
100.0

Viscosity reduction
30 sec No. 2 Zahn Cup
Solvent — Xylene

Table 7—White Paint

Resin	NVM (D-2396)	lb/gal (D-1475)	VOC[a]
Low VOC			
A (soft)	17	12.3	2.9/348
B (hard)	83	12.3	2.1/252
C (hard)	74	12.3	3.2/383
High VOC			
D (soft)	54	10.3	4.8/575
E (hard)	56	10.5	4.7/563

(a) EPA Reference Method 24 (lb/gal/g/L).

Table 8—White Paint[a]

Resin	60° Gloss (D-525)	Hardness (D-3363)	Adhesion (D-3359)	Solvent Resistance[b] MEK	Toluene
Low VOC					
A (soft)	4	3B	100	100	100
B (hard) ...	25	H	100	18	27
C (hard) ...	23	F	100	8	9
High VOC					
D (soft)	54	2B	100	2	2
E (hard)	57	B	82	2	2

(a) Treated cold-rolled steel panels — cured 30 min 450°F.
(b) Double rubs with cheese cloth covered 20 oz ball peen hammer.

Table 9—White Paint [Heat Resistance (482°F)]

Resin	60°Gloss (D-523)				ΔE Color (D-2244)			Condition[a]		
	0	100	300	500	100	300	500	100	300	500
Low VOC										
A (soft)	4	5	5	5	1.1	1.2	1.0	10	10	10
B (hard)	25	18	17	16	0.9	0.8	0.7	10	10	10
C (hard)	23	27	26	26	1.3	1.0	0.9	10	10	10
High VOC										
D (soft)	54	31	32	31	0.9	0.8	1.0	10	10	10
E (hard)	57	52	54	51	1.2	1.0	1.0	10	10	10

(a) 10 = No failure.

tested for solution properties, cured on steel panels, and tested for film and heat resistance properties.

Aluminum Paints

Silicone aluminum paints were prepared with Resins A, B, D, and E. Leafing aluminum paste was mixed with the resin on a low RPM blade (*Table 2*) and the four paints reduced with xylene to spray viscosity.

Resins A and B resulted in paints which had lower VOC values as compared to the high VOC paints as shown in *Table 3*. Paints were sprayed on cold-rolled steel panels (.032) and cured 30 min at 450°F. Paint B was catalyzed with tetraisopropyltitanate at 6% based on resin solids. Film properties are shown in *Table 4*. Adhesion measured by cross-cut and solvent resistance was about equal for all coatings. The same paints were sprayed on 12 gauge sandblasted cold-rolled steel panels and also cured 30 min at 450°F. Panels were put in a muffle furnace at 1000°F and evaluated for failure at 100, 250, and 500 hr. There was little difference in failure for the four coatings after 500 hr exposure as shown in *Table 5*. Failure was defined as film loss, cracking, or checking.

White Paints

White silicone paints were prepared with all five resins. Titanium dioxide, mica, and resins were dispersed

with a high speed blade at 3200 RPM for 15 min. The white paints were reduced to spray viscosity with xylene (*Table 6*).

The paint with the lowest VOC was Resin B which is the multiple functional resin. The VOC of this paint was less than half the VOC for the hard, high VOC paint (*Table 7*).

The five white paints were sprayed on Bonderite® (Parker Rust Proof Co., Detroit, MI) 1000 treated cold-rolled steel panels and cured 30 min at 450°F. Coating properties were tested as found in *Table 8*. The soft, low VOC resin was low in gloss, but had good solvent resistance. All coatings had good cross-cut adhesion.

Panels were exposed to 500 hr at 482°F (250°C) and measured for gloss retention, color change, and general condition. Properties as shown in *Table 9* indicate little change in the coatings after heat aging.

CONCLUSIONS

Because of increasing pressure to reduce VOC content of high performance coatings, a study of alternative low VOC polyorganosiloxanes was made. These products were compared as resin solutions, paints, and high temperature properties with low solids high VOC polyorganosiloxanes.

Low molecular weight polyorganosiloxanes that are crosslinked either through silanol condensation or catalyzed silanol alkoxy reaction are capable of producing low VOC generating high temperature protective coatings. Performance of the cured and tested coatings is similar to low solids, high VOC polyorganosiloxanes currently available.

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Coatings Based on Polymer/Polymer Composites

V.V. Verkholantsev*

Research and Design Institute
for Paint and Varnish Industry

The term polymer/polymer composites (PPC) applies to heterophase polymer blends, obtained in the process of synthesis by mixing polymers in bulk, solution, or dispersion, or by phase decomposition of initially homophase polymer blends. Homophase solutions of two or more incompatible polymers can be obtained using the common solvent—frequently two or multicomponent mixtures of organic solvents. Under a certain condition, and particularly during the solvent evaporation and curing process, these systems form heterophase, nonhomogeneous-in-layer or double-layer coatings. From solutions of solid epoxy + perchlorovinyl resin, epoxy + polysiloxane, and from other partly compatible polymer blends, which lead to phase separation and sometimes to self-stratification during the film forming process, these new types of solvent-based anticorrosive and weather resistant enamels were introduced into the market as one-coat topcoat/primers.

These epoxy-based enamels were ambient cured (two-component), applied to a conventionally prepared metal surface by one step regular or airless spraying. The recommended dry film thickness is 60-200 microns. In relation to protective functions and service life, these one-coat materials are adequate for multilayer conventional coatings, based on the same film formers.

INTRODUCTION

The majority of modern industrial organic coatings are complex multilayer systems. They consist of layers of different coating materials, for instance, one or two layers of adhesive and anticorrosive primer plus two or more layers of weather resistant composition. During the last few years, a number of serious theories predicted, with practical confirmation, that the use of heterophase film forming systems with a special controlled polymer structure could provide significant enhancement of mechanical and protective functions of organic coatings, instead of the regular homophase polymer binders.

From 1950, the heterophase materials (composites) were in use almost exclusively as construction materials. Their application area gradually expanded involving the industrial use of more and more heterophase materials of different type and composition in various fields. Today,

many more heterophase materials belong to the composite family which are distinguished by their matrix material (metal, polymer, glass, ceramic, etc.) and reinforcement (fibers, fillers, and laminates of different chemical nature).[1,2]

The heterogeneous polymer mixtures, which can be two- or multicomponent blends, also should be considered as polymer/polymer composites (PPC). Here both the matrix and reinforcing phases (coherent and incoherent phases, respectively) are polymers of essentially different chemical nature. This is given by the difference in their polarity, and in the type of their intermolecular forces, which leads to their thermodynamic incompatibility. Strictly speaking, the incompatibility of any components, including polymers, cannot be absolute, that is, complete, and we should suggest that incompatible polymer blends are always partially compatible.

PPC can be produced by impregnation of synthetic or natural polymer reinforcement (fiber, textile, paper, felt, etc.) with polymer solution, dispersion, or liquid resin;[1] by direct synthesis of different polymers simultaneously

(ABS-plastics, unimpact polystyrene, etc.;[3] or by mixing the polymers in melt, powder, solution, dispersion, or possibly some other fluid form (epoxy-rubber compositions, polymer-extended binders, glues and sealants,[4-7] etc.). However, there is a possibility of obtaining PPC as heterophase material from the initially homophase blends, melts, or solutions due to the phase decomposition.

In contrast to homophase polymer mixtures, in the case of PPC, nonadditive dependence of properties on composition always takes place. In contrast to the inorganic composites, the PPC are peculiar in having a significant, and sometimes comparatively extended, polymolecular transfer layer as a border between coexisting phases. Once the components for PPC and their ratio are selected, the properties of material in the final state will also depend on polymer structure.

It is feasible to obtain identical compositions with different properties through varying technological treatment, resulting in different polymer structures.[8,9] However, the practical use of PPC in organic coatings has begun only recently,[10] but development in literature is progressing very fast.[11-21]

PPC STRUCTURE

The polymer structure serves to describe the dependence of particular technical properties of polymer materials on chemical composition and technological parameters related to their acquisition or treatment.

The structure of polymers can be described in three levels—molecular, polymolecular (or subphase), and phase structural levels. Correspondingly, average sizes of structural units are on the order of 10-50 Å (the size of monomers or kinetic segment), 100-1000 Å (polymer molecules), and 0.1-10 microns (phase particles).[22] Any description of polymer structure considers the molecular level as a structureless media, and the polymolecular structure in homophase polymers or polymer blends, as well as phase structure in heterophase polymers and polymer mixtures (crystalline type polymers, PPC, etc.), is considered as "structure modifying," which sometimes changes quite significantly the properties of the molecular structure matrix.

The conventional film formers, even if they are mixtures of polymers or oligomers, give organic coatings in homogeneous form, with reproducible film properties. The homogeneity implies the uniformity of position of different molecular species within the film. This is especially important in the case of intermolecular joint hardening alkyd-melamine blends, isocyanate-polyol systems, and epoxy and hardener systems, etc. Polymolecular structure of conventional film formers and its influence on coating properties was the fashion topic during the 1960s and 1970s.[23-26]

Concepts of phase polymer structure, which particularly provide a background for a structural approach to PPC, have been elaborated.[3,5,6,26] Many attempts have been made for conceptual and quantitative assessment of the correspondence between the polymer-based composites structure and their properties, such as density, rheology, gas/liquid diffusion, mechanical properties, etc.[26-28]

Most of these concepts cannot allow for all the structural factors (some of which are, unfortunately, not common to every polymer), and in the case of the PPC, their "predictive capacity" is sometimes deficient for practical purposes, especially in relation to such complex coating properties as adhesion, permeability, weather resistance, etc.

The most important structure parameters of PPC are:

(1) TYPE OF DISPERSE STRUCTURE (like the types of emulsion). The different groups are: dispersions (e.g., the incoherent phase α is dispersed in the coherent phase β, indicated as α/β, or the reverse system, β/α) and mutually penetrating networks.

The more complex types of these PPC structures can be denoted as multidispersion and mixed dispersion. Particularly, the multidispersion $\alpha/\beta/\alpha$ consists of dispersion α/β in α, that is, one continuous and two dispersion phases; the reverse dispersion of the same type is $\beta/\alpha/\beta$. The mixed dispersion should be denoted following the same principles as $\alpha/\beta + \beta/\alpha$ (for two-phase dispersion), but also may be described as the "phase inversion point," being at the same time a special case of a mutually penetrating network structure.

The structural forms of heterophase polymer mixtures usually detected by light or electron microscopy are very complex.[6,26] Nevertheless, in some cases, it is possible to simplify such complex structures to some elements which are suitable and sufficient for correspondence between the PPC structure and properties.[29] The colloid structure of polymer/polymer systems and its transformation during the phase decomposition is studied fundamentally and described in a number of monographs and review articles.[6,26,30]

(2) VALUE OF SPECIFIC INTERPHASE SURFACE (S_{sp}) between the phases of different composition. For the simplest composite structure consisting of spherical particles of diameter, d, the S_{sp} value may be calculated from this simple relationship $S_{sp} = 6\zeta/d$, where ζ is the volume fraction of the incoherent phase. As a rule, all real disperse systems are polydisperse, and another structure parameter may be introduced—the number or weight particle size, d, distribution.

The specific surface is the most useful index of the heterogeneity, and the majority of technical properties of the heterophase mixtures change significantly with the S_{sp} value; hence, the S_{sp} value may be considered the first measure of "compositivity." The increase in the S_{sp} value, designed to improve properties of PPC, may be obtained by increasing the ζ value and decreasing the d value of incoherent phase particles.

(3) SHAPE AND ANISODYMETRY OF INCOHERENT PHASE PARTICLES. For example, replacing the spheric particles with fibers (when the ζ value remains constant) tremendously reinforced the mechanical properties of the polymer-matrix composites.

(4) UNIFORMITY OF DISTRIBUTION OF POLYMER AND PHASE PARTICLES THROUGH THE VOLUME OF MATERIAL. The highest uniformity corresponds to the equal thickness of polymer matrix layers between the incorporated disperse particles, which are polydisperse.

XYLENE

(a)

S

A'

A

ACETONE

B'

B

B'

ER   C''   P
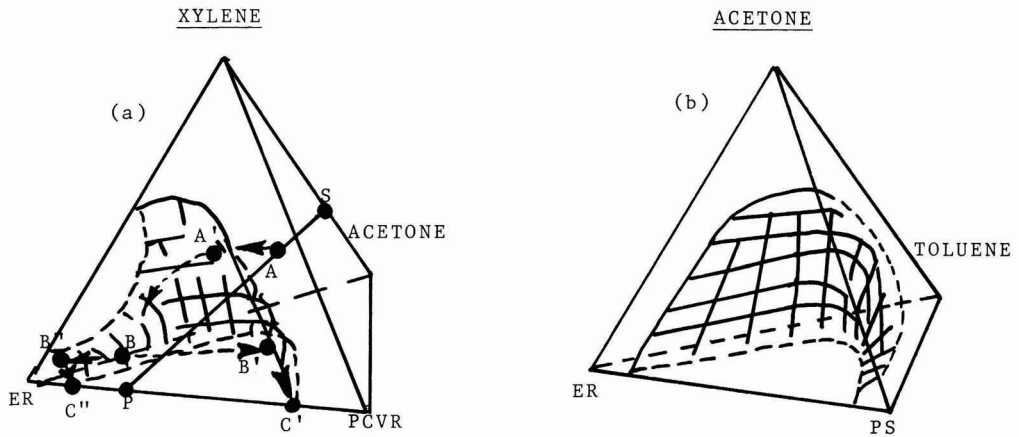
C'   PCVR

ACETONE

(b)

TOLUENE

ER

PS

Figure 1—Phase diagrams of four-component polymer systems: a—ER + PCVR + acetone + xylene; b—ER + PS + acetone + toluene

(5) THE DURABILITY OF INTERPHASE CONTACTS can be expressed in structural terms through the thickness of interphase transfer layers. Thickness greater than approximately 50 Å corresponds to the polymolecular boundary layer consisting of both polymers. Their concentration changes gradiently from the phase enriched with the first polymer to the phase which consists predominately of the second polymer. This transfer layer may be considered as the "third phase" and as a peculiarity of PPC.[31-33] These structural parameters are widely explored in quantative concepts of PPC as well as the correspondent "bulk properties" of each phase (e.g., modules of deformation for the calculation of mechanical properties[34]).

(6) STRUCTURAL DESCRIPTION OF FILMS AND COATINGS demands the additional structural parameters—the gradient of structure as well as chemical composition throughout the film thickness—that is, the degree of homogeneity-in-layer. Concentration of any component along the coating thickness may change step-wise, gradually, or remain constant along some part of the thickness. In general, PPC coatings' structure could be described as the combination of these variants. The extreme case of nonhomogeneity-in-layer is the double-layer coating structure.

COATING COMPOSITIONS BASED ON PPC

History

The systematic study in PPC for coatings was begun at the Coatings Research Institute, in Moscow, in 1975. The initial concept has grown from results obtained on formulation of marine coatings based on partly compatible polymer blends as film formers which displayed extremely high resistance against cavitation in a submerged surface.[14] The study of coatings structure discovered the microheterophase and unhomogeneous-in-layer nature of these coatings.[35]

The beginning of this work coincided with detailed publications by Funke,[11,12] who suggested improvement in coating properties due to controlled heterogeneity and self-stratification during the film forming process. This idea then was applied to powder coatings, where self-stratification of incompatible polymer blends could be realized easily during the heating stage of the film forming process.[13]

However, the analysis of some results led us to the conclusion that essential reinforcing and increasing of coating durability may be achieved not by copying the multilayer structure of traditional coatings, but preferably by the forming of certain microheterogeneity of the polymer matrix. This does not exclude the possibility of improving coating properties by nonuniformity through the coating thickness. It was found that the controlled heterogeneity of the polymer film former, as well as nonhomogeneity-in-layer, can be obtained by using a combination of an incompatible polymer blend with at least two solvents of different volatility and affinity to both polymers, which is very convenient for coatings technology. The second "driving force" of phase separation is the curing process. For instance, the initial film forming system can be formulated by the dissolution of a curable oligomer/thermoplastic partly compatible polymer blend in a mixed common solvent (two or more individual solvents). Due to solvent evaporation on application, such a solution transfers into a two-phase state, that is, it undergoes phase separation on the substrate, forming microheterophase or, under certain conditions, nonhomogeneous-in-layer coatings. Some basics and specific features of this process were described in review papers.[15,19] Since 1989, the Paint Research Association started the Self-Stratifying Coatings Project,[20] and the very useful thermodynamic approach to PPC was described in the work.[21]

It should be mentioned that both coatings described in the literature as types of heterophase matrix-based polymer coatings—microheterophase and nonhomogeneous-in-layer (i.e., self-stratifying), belong to PPC coatings. The focus in the following section will be on the PPC-coating obtained from the coating composition. Initially, it is a one-phase solution of incompatible polymer blends which then forms the PPC-coating during the film forming process on a substrate.

Incompatible Polymer Blends for PPC

Many pairs of polymers are incompatible.[36-38] Mere combinations of commonly used commercial film forming resins are incompatible enough to form one-phase undiluted solutions, and then two-phase PPC-coatings with valuable properties.

Examples of such partly compatible polymer blends which have been used for PPC-coatings' formulations include:

Epoxy resin (ER) + perchlorovinyl resin (PCVR)[15,18,19]
ER + chlorinated rubber[14,35,39]
ER + acrylic copolymer[20]
ER + polysiloxane (PS)[19]
Polyester resin + PS[40]
Polyester resin + acrylic copolymers[40] and
Alkyd resin + acrylic copolymers.[40]

In comparison with initial two-phase film formers (for example, with the previously mentioned epoxy-rubber compositions[41,42]) the initial one-phase film forming systems for PPC-coatings may be considered as more acceptable due to their conventional technology, stability on storage, and reliability in obtaining a desirable polymer
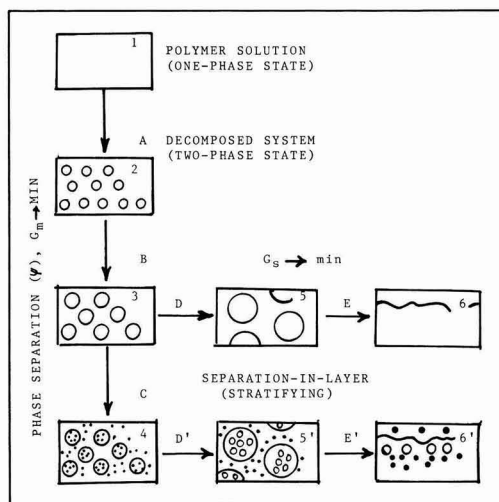

Figure 2—Schematic representation of phase and structural changes during formation of PPC-coatings by phase decomposition and corresponding elimination of the free energy of mixing (G_m) and free energy of the interphase surface (G_s)

structure, and correspondingly, the reproducibility of coating properties.

Phase Separation During the Film Forming Process

The PPC film formation process can be illustrated by the simplest model composition comprising two incompatible polymers and two solvents distinguished by volatility and thermodynamic affinity to each polymer.

For practical purposes, such a multicomponent polymer system should have a sufficiently large region of a one-phase state, but also a significant region of a two-phase state, enough for the development of the phase separation process, that is, the space of the two-phase state on a phase diagram should be enough to obtain the heterophase structure despite the high viscosity of composition on the final step of the film forming process.

A suitable example is supplied by the systems of solid ER + PCVR + acetone + xylene.[19] The experimental phase diagram for this system is shown in *Figure 1*.

The parabolic surface limits the space inside the pyramid, corresponding to the two-phase state, that is, the space of phase decomposition.

Let us select the "point of composition" A which reflects the initial composition of a four-component solution in one-phase region [*Figure* 1(a)]. Naturally, this point should be situated on the line connecting points P and S, which express the initial ratio between polymers and solvents correspondingly.

When solvents evaporate from the liquid film forming layer, their absolute and relative contents change and the point of composition moves in the direction of point P. At a specific moment, it would cross the border surface. Theoretically, from this moment the system will undergo the phase separation, forming a two-phase liquid system. In practice, the phase decomposition begins after a certain delay due to inclination of the polymer system to relax. Moreover, the cross-point A' should be situated not on the line PS, but certainly outside because of the difference in volatility of solvents.

Due to the higher volatility of acetone, point A' must correspond to the solvent composition with relatively higher xylene content than it had in the initial point A. The composition of each separated phase can be determined by the location of point A on the border surface and tracing from A' to point P, where, theoretically, the system should consist only of nonvolatile components and be separated into two phases of composition corresponding to points C' and C". This should occur if both phases remain liquid, that is, in the absence of any kinetic restrictions. Real polymer systems should "solidify" when the average composition related, for instance, to point B, and the composition of the separated solid phases corresponds to points B' and B". Then, on losing the residual amount of solvent (lower volatile xylene), each phase should undergo the "secondary" phase separation moving to points C' and C", but they cannot be separated completely.

The positions of C' and C" on the polymer concentration scale means that both phases forming after phase decomposition consist of both polymers, but in different ratios.
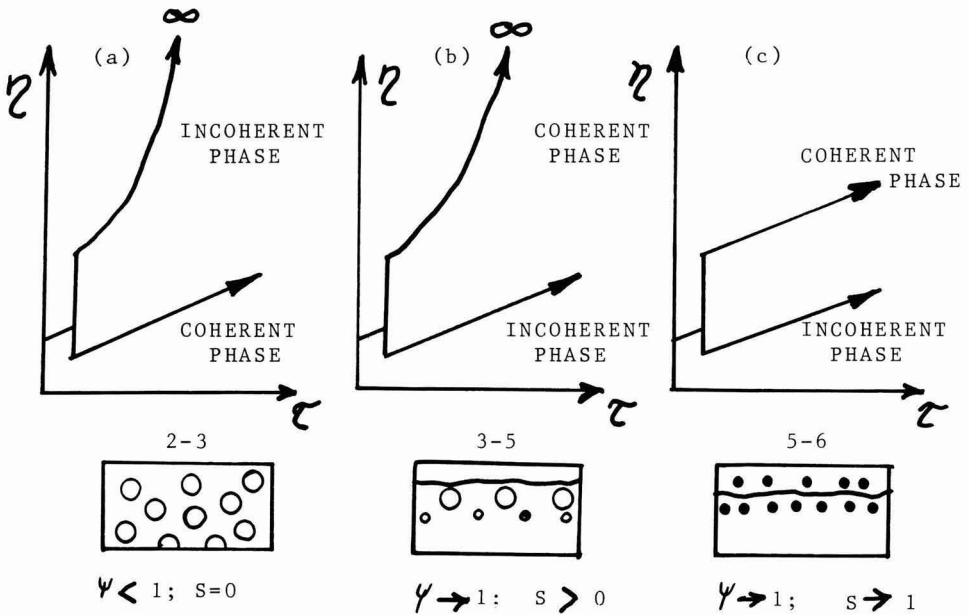
Figure 3—Change in viscosity of polymer-consisted liquid phases during evaporation of solvent resulting in degree of phase separation (ψ) and stratifying (S); number of illustrations corresponds to the number in *Figure 2*

Shown in *Figure 2* are the main stages of separation of such a system due to solvent evaporation. Parallel with the phase transformation of the system, that is, phase separation on moving from A′ to B (*Figure 1a* and reflected by the vertical line in *Figure 2*), causes the elimination of the interphase surface free energy up to the formation of a double-layer film (horizontal rows), that is, self-stratification. The secondary separation during the B′ —> C′ and B″ —> C″ movements (*Figure 1a*) corresponds with *Figure 2* and results in formation of multidispersion (forms C, D′, and E′).

The main feature of phase separation during solvent evaporation is nonequilibrium of the system. The insufficiency of this analysis is that in these terms it is impossible to predict the point of solidifying, and correspondingly, the degree of phase separation and stratification. Hence, the application of phase diagrams for analysis of phase transformation is approximate and can be used as a qualitative examination of system behavior.

Another characteristic trait of the process is the possibility of separation, either by a nucleation process, or by a spinoidal mechanism depending on the process circumstances and diffusion mobility of the polymers. Phase separation by nucleation, when the new phase separates from the mother phase as growing particles (emulsion), then coalesces, and possibly forms stratifying layers, can be realized during the low change in parameters of the system, for instance, on slow solvent evaporation. It can also be brought about if the separating phase has sufficient fluidity, such as, when this phase is more diluted, or enriched with a lower molecular weight polymer. The

polymer component contained in the polymer blend in deficiency should enrich the separating phase, the phase escaping from the mother phase.
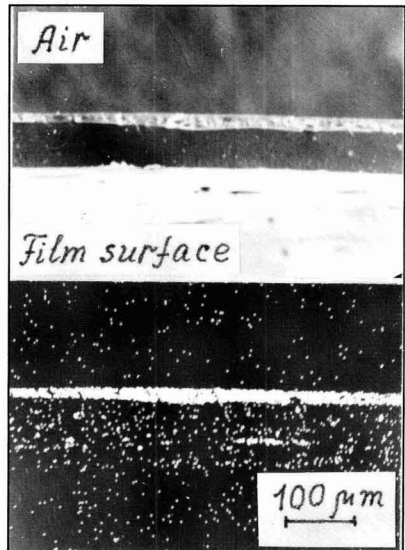

Figure 4—SEM micrographs in regular or the Cl-absorbing spectral line of film cross sections (ER/PCVR, 90/10 by wt). Top—PCVR-enriched layer; and bottom—EP-enriched layer
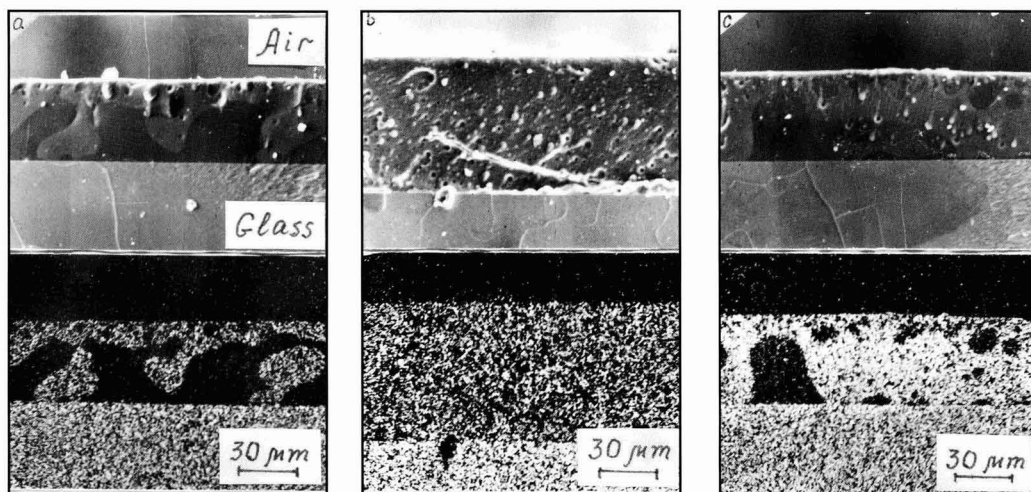
Figure 5—SEM micrographs in regular or Si-absorbing spectral line of ER/PS film cross sections (by wt): a—70/30; b—50/50; and c—30/70

In the opposite case, the spinoidal type of phase decomposition occurs more frequently, due to intensive evaporation of solvents and correspondingly to rapid phase separation. Here the mutual penetrating network of separated phases form as an initial type of liquid structure.

Nevertheless, although this structure usually results from spinodal type phase decomposition, the final solid film generally does not show this structure. This structure, where both phases are continuous and disperse, in a liquid system has enough time to transform into a more simple and less disperse structural form (driven by the interfacial surface tension forces).

Some authors consider the nucleogenic separation as the more appropriate type for the polymer system.[6] It should be pointed out that the formation and preservation of a structure arising from this type of phase decomposition depends, to a certain extent, on the kinetic characteristics of polymer components (chain length and flexibility), and circumstances of phase decomposition on the film forming process—velocity of solvent evaporation, temperature, layer thickness, etc. The difference in mechanism of phase decomposition leads also to a certain difference in the PPC-coating structure.

In particular, the structure of PPC-coatings obtained from the system ER + PS + acetone + toluene on solvent evaporation corresponds to the nucleogenic type of phase separation. The system ER + PCVR + acetone + xylene shows either nucleogenic or spinoidal decomposition, depending on what side of the parabolic border surface that point A′ will cross, moving into a two-phase state on solvent evaporation.[19] The process of solvent evaporation is accompanied by changes in the viscosity of the polymer system and, then, separated phases (*Figure* 3). The degree of phase separation (ψ) and layer separation (S) is dependent on the velocity of solidifying in both coherent and incoherent phases, respectively. High values of ψ and S (close to one) can be obtained only by slowly increasing the viscosity of both phases (C-version).

The illustrations in the bottom portion of *Figure* 3 correspond to the diagrams in *Figure* 2, and show schematically the influence of change in viscosity of separated phases on degree of phase separation and stratification. Under the real conditions of a PPC-coating formation, the calculated ψ values for ER + PS coatings were up to ~0.5 and up to 0.84 for ER + PCVR, while the self-stratifying coating structure realized in the case of the ER + PS blend and S value was not more than 0.05-0.1.[19] Moreover, the ψ values can be increased with the help of the curing process,[19,29] and S′ values—by heating.

Figures 4 and 5 show scanning electron microscopy (SEM) micrographs of the film sections. These films were obtained on a glass substrate from solutions of polymer blends and were split together with the glass panels under cooling by liquid nitrogen. Samples for SEM were prepared by C or Au-vacuum deposition sometimes without delamination from the glass substrate.

The structure of the typical double-layer self-stratified film obtained from the ER + PCVR solution is shown in *Figure* 4. On the right side of the figure is the micrograph obtained by means of the chlorine-absorbing spectral lines, indicating that the top layer is enriched with PCVR. Here, $\psi \longrightarrow 0.8$ and $S \longrightarrow 1.0$ are obtained from the spinoidal type of phase separation.

The structure of three films (*Figure* 5) of different composition obtained from the ER + PS solution (nucleation type of phase separation) reflects distinct, but not complete stratification for the ER/PS 70/30 films (the top layer enriched with PS), no stratification for the 50/50 films (phase separation produces the microheterophase structure), and poor stratification for the ER/PS 30/70. From the last picture we can see that the selective wetting
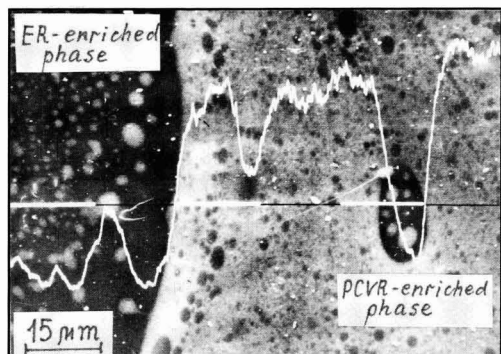
Figure 6—Microprobe analysis (Cl-absorbing spectral line) of polymer film surface ER/PCVR, 50/50 by wt reflecting the change in PCVR concentration

of the glass substrate is in favor of the ER-enriched phase.

Figure 6 shows SEM micrographs obtained with a microprobe X-ray (chlorine-absorbing line) analysis of the ER/PCVR-blend film surface. The darker phase is enriched with ER and the light one is enriched with PCVR. The coherent phase shows a certain gradient of PCVR-content in direction to the ER-enriched phase. The lower content of alien phase particles in the vicinity of the interphase border also can be identified. According to the slope of microprobe curve crossing the interphase between ER- and PCVR-enriched phases, the transfer polymolecular border layer is not more than a few microns.

These features of polymer structure correspond fairly to the "percolative conception" of phase decomposition of polymer solutions.[43] Following this concept, the resulting structure is formed by the coalescence of growing particles of the separated phase due to the unstability of mother phase layers between these particles. A number of monographs and review papers, dedicated to the mechanism of phase separation and to the structure of phase

decomposed polymer systems, can be recommended.[3,5,6,26,44,45]

Inside any polymer composition undergoing the phase separation there is a trend toward self-stratification, caused as was stated previously, by the forces of interfacial tension between liquid phases and chemical forces during the curing process. On film formation, these forces become orientated due to the difference in the viscosity of the top and lower parts of drying layer, to the wetting of the substrate, to film contraction, and possibly to some other causes, particularly due to the well-known Marangony's effect. Depending on the strength of these forces, and velocity of increase in viscosity of the liquid system on solvent evaporation, this trend can result in two-layer films or prove to be inadequate for self-stratification.

In the latter case, the system results in the self-separated microheterophase, but homogeneous-in-layer polymer film. As a rule, a complete self-stratified film can be formed with a slow or without any curing process, and as a result of a sufficient long heating time above the flow point temperature of both film formers (*Figure* 7a). The typical microheterophase structure with insignificant tendency to nonhomogeneity-in-layer is shown in *Figure* 7b. The most practical self-stratifying structure, consisting of only a thin clear homophase layer and a thick heterophase "bulk part" of coating, is illustrated by *Figure* 7e.

Phase decomposition of polymer systems in the presence of inorganic disperse phases is the subject of particular interest for coating compositions, but has been studied much less than unfilled polymer blends.[46-48] Some results can be explored in practice in a qualitative approach.

As far as we know, there are no special restrictions for using regular pigments and extenders in PPC-coatings, and in particular in self-stratifying coatings compositions.

Generally speaking, the structure of PPC which is formed from a one phase solution of partially compatible polymer blends due to phase composition depends on the thermodynamic characteristics of polymers (determining
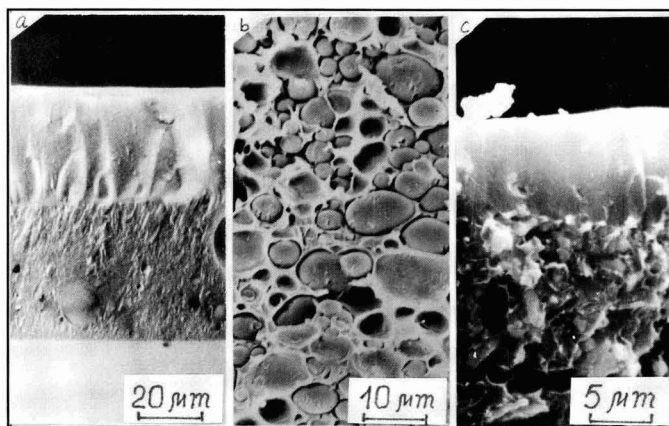

Figure 7—SEM micrographs of film sections: a—double-layer, ER/PS 75/25, 180°C, cured without hardener; b—microheterophase ER/PCVR, 50/50 (ambient cure, amine-type hardener); and c—self-stratifying: homophase top layer + heterophase lower part of the coating (ER/PS, 75/25, amine-type hardener)

Table 1—Durability of PPC-Coatings Compared with Industrial Enamels Based on PCVR or EO (total thickness 100-120 microns)[19]

Test	Conventional (3 coats)		Compositive (1 coat)	
	PCVR[a]	ER[b]	ER/PCVR	ER/PS
Weathering (cyclical)	20	20	400	500
Temperature interval (cyclical)[c]	20	50	200	250
Tropical conditions (cyclical).............	10	40	50	100

(a) PCVR applied on a phenolic-type primer.
(b) ER applied on an acrylic primer.
(c) The following cycle was applied: 6 hr at −40°C; 18 hr at +40°C; relative humidity 98%.

their compatibility), their kinetic characteristics (determining their behaviors in the phase decomposition process), thermodynamic and kinetic properties of the volatile components, and circumstances of the process.

In practice, the structure and properties of PPC-coatings can be controlled by:

Chemical nature and molecular characteristics of film forming polymers and their ratio in formulation.

Thermodynamic affinity of solvents to polymers, their volatility, and the contents in coating compositions.

Incorporation in formulation of special components to control the compatibility[49] and surface properties[19] of decomposed liquid phases.

Circumstances of application (usually by spraying).

Velocity of the curing process.

Coating Compositions

Based on described compositive ''ideology,'' and as a result of certain experimental research, the main principles of PPC-coatings technology were developed exploring the usual production scheme of solvent-based coating compositions.

Production of industrial materials began in the USSR in 1987 for application as one layer topcoat/primer enamels. These enamels consisted of mixtures of incompatible resins dissolved in mixed organic solvent, forming microheterophase nonhomogeneous-in-layer compositive coatings due to the spontaneous phase separation of the film forming process.[10]

The enamels introduced were intended for weather/ anticorrosive industrial coatings. They can be applied in one coat (one layer) by regular or airless spray to a cleaned or prepared metal surface, or possibly to some other substrate, with a dry film thickness 60-200 microns, ambient cure (two-component).

In comparing conventional multilayer coating systems of the same thickness to one-coat PPC-coatings, the latter usually displayed the same or sometimes higher protective properties and service life[10,19] (see, for instance, the comparative test results in *Table 1*).

Some of the possible applications of PPC coatings based on the previously stated polymer blends include: weather, chemical, and corrosion resistant coatings for industry and building, equipment of chemical units, marine paints, etc.

The advantages of PPC-coatings are as follows: one-coat application; high thickness by one-step spraying; high protection, long service life; and no problem with interlayer adhesion.

The industrial exploration of PPC-coatings shows the possibility of reliable production with essentially higher properties in comparison to coatings based on homophase film formers. Also, in relation to the high durability of PPC-coatings some reasons can be suggested.

During the service life, the internal stress of the coating does not increase due to extinguishing the highly developed interphase surface. The microcracks do not grow in the coherent polymer phase of the coating, having been localized in the thin layers between particles of the incoherent phase.[50] For example, that is the reason why the vapor permeability of PPC-coatings increases very slowly during service life. If the composition and structure of PPC-based coating are selected and formed successfully, resistance to external influences is further decreased slowly by the fact that PPC-coatings possess free energy in profusion, which could be spent on fitable structural transformations. This is also the reason why the microheterophase structure is more important for the PPC-coating than the self-stratifying. The latter, however, could provide the coating with valuable surface properties.

Based on the results that have been described briefly in this paper, PPC-based coatings can be recommended as the reason for application of solvents in organic coatings technology.

ACKNOWLEDGMENT

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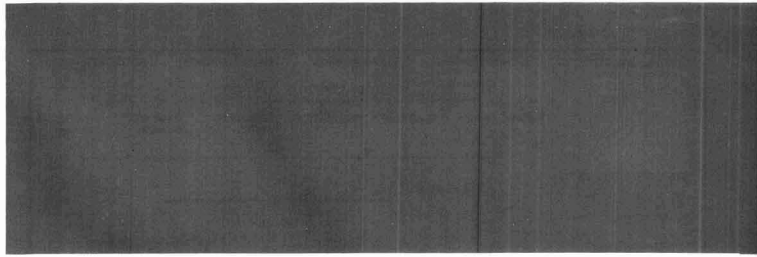
Toward a Unified Strategy Of Service Life Prediction

Ray A. Dickie
Ford Motor Company*

The prediction of coating service life is one of the toughest problems that face the coatings chemist. In this paper, a general framework connecting laboratory experiments, field exposure history, and theoretical and empirical models is suggested. The central role of physical and chemical models of degradation processes in service life prediction is highlighted.

Introduction

A prediction of service life is implicit in most performance testing of materials. The pressures of material and process development require that performance testing and service life prediction be rapid and reliable. Documentation of performance under actual use conditions is essential but time consuming. As a result, it is often neglected until late in a materials development. Accelerated laboratory tests are widely used because of their simplicity, reproducibility, and speed. An optimal methodology for the prediction of service life should incorporate elements of accelerated testing, real world performance observation, and a number of other factors. This paper presents some thoughts on the elements of such a methodology and on how they can be combined into a coherent whole.

The issues surrounding prediction of service life are most easily discussed using examples. Two general examples are used in the present discussion: evaluation of paint durability in weathering experiments, and testing of the corrosion resistance of painted steels. It is not the intent of this paper to provide a critical review of either area. The work cited has been chosen to illustrate the points of discussion, but the reference list is by no means comprehensive.

For many years, the prime criterion for durability of automotive topcoats has been the performance of the coatings under exposure to a severe, but natural, environment. Typically, gloss and physical integrity are monitored for two to five years of outdoor exposure under specified conditions in Florida.

Laboratory accelerated tests have long been used for more rapid evaluation of coating performance. These tests typically have relied on exposure chambers that subject samples to high humidity and intense light. Under some conditions, coatings exposed in accelerated tests experience chemical changes that do not occur under outdoor exposure conditions. Such chemical changes have sometimes been referred to as "unnatural chemistry." Changes in the chemistry of degradation during accelerated exposure may result only in changes in relative rates of degradation. It is well known, however, that reversals in ranking of materials also can occur. The resulting uncertainty has given rise to a long running debate on the relative merits of various exposure schemes and test protocols. An elaborate protocol based on a combination of measurements of the initial rate of certain fundamental degradation processes, spectroscopic verification of degradation mechanisms, and natural exposure has been proposed.[1] Even so, prediction of service life under realistic exposure conditions remains an elusive goal.

Evaluation of the corrosion of paint systems provides a second example. Salt spray exposure has been used as the standard method for evaluation of corrosion performance in many studies of paint performance. Specific levels of salt spray performance are called for in many paint specifications. Corrosion failure in salt spray or other laboratory tests can be subjected to rigorous statistical analysis, and predictions of failure can be made.[2] Correlation with service conditions is more difficult.

Many cyclic exposure tests have been proposed for evaluation of the corrosion resistance of paint systems.[3] Initially, cyclic exposure methods were designed to generate total system performance results that more closely mimicked failures observed under actual service conditions. Criteria for the evaluation of the test methods included, for example, the overall appearance of tested parts and the relative rates of painted metal perforation.[4] The merits of cyclic tests have been discussed extensively. The ranking of coating systems on a given substrate is typically not much affected by details of the exposure conditions; wet time is probably the most important variable. Comparisons of coatings on different substrates (e.g., galvanized vs cold-rolled steel) do, however,
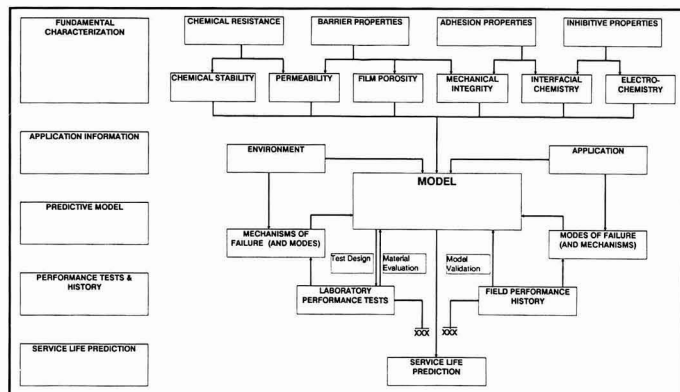
Figure 1—Corrosion performance prediction methodology

show a strong dependence on the details of the exposure conditions. The results of the cyclic evaluations for total systems (substrate, pretreatment, and coating) are more nearly consistent with service experience in appearance and in ranking than are the results of continuous exposure. Again there are subtle differences in mechanisms of failure, and not so subtle differences in exposure regimes, that make prediction of service life problematic.

These examples illustrate dichotomies between "laboratory tests" and "real world exposure," between "accelerated tests" and "early detection of failure processes," between "correlation" and "life statistics," and between "performance" and "mechanism" studies. These approaches are parts of what should be an interconnected whole: a continuum of testing, understanding, and prediction. The real issue is not replacement of service performance evaluation by laboratory testing, but rather of integration of information from different techniques and ap-

proaches to achieve reliable life prediction. The scheme in *Figure 1* is an attempt to set these issues into context.[5]

In the scheme outlined in *Figure 1*, service life prediction is considered the outcome of applying a predictive model. The model is based on three key elements: first, a characterization of materials and failure processes; second, an analysis of the envi-

ronment and of the intended application; and third, a history of material performance in laboratory tests and actual service. The specific scheme outlined in *Figure 1* is directed toward evaluation of corrosion performance. The concept is, however, broadly applicable to service life prediction for materials subject to chemical and physical degradation processes in a broad range of applications and environments. Each element of the scheme is considered in the discussion that follows.

Field Performance Evaluation

Field performance evaluation plays two important roles in the development of a predictive model. One is as a reference or criterion against which the results of laboratory tests and productive models can be judged. The other role is as a source of information on modes of failure. Field performance evaluation *per se* supplies little information on individual failure processes. However,

careful observation of failure modes—that is, of how failure starts, and of how the process proceeds—can provide the basis for designing controlled laboratory studies that allow the mechanisms and rates of individual failure processes to be determined. It also can provide the basis for modifying the design of a component or for selecting a material to suppress particular modes of

failure. Definition of the interfacial processes and identification of rate controlling steps then becomes an essential part both of the formulation of a predictive model and of a strategy for developing and implementing improved materials, designs, and test methods.

Corrosion of painted steel has long been observed, for example, to begin as a disruption of adhesion by chemical or physical means. Only later in the process is the underlying, initially unexposed metal observed to corrode. A consideration of the corrosion process in electrochemical terms suggests the possible role of anodic and cathodic processes in the adhesion disruption; fundamental mechanistic tests designed to separate the respective half reactions allow the role of these processes to be sorted out.[6]

Field performance data play an essential role in the validation of predictive models. In addition, predictive models provide a means of generalizing results, allowing rational prediction of results of other test or exposure conditions and for other materials.

Laboratory Performance Tests

In the development of a model of failure processes, laboratory performance tests can provide insight into failure mechanisms by allowing individual environmental factors to be controlled. This approach in effect exploits one of the intrinsic weaknesses of most accelerated tests—differential acceleration of degradation processes—and puts it to good use. What can be gained by such work is insight into the underlying mechanisms of degradation processes. This is especially true when laboratory tests of performance are used in combination with more fundamental studies. Thus, for example, simple laboratory tests of performance can easily demonstrate (but not explain) the role of the spectral distribution of incident illumination and of humidity in paint weathering. Establishing the underlying cause(s) of the observed dependencies requires elucidation of the physical and chemical mechanisms of degradation.

The best use of laboratory performance tests may be to provide a means of assessing the sensitivity of materials to one or another of the *specific* degradation mechanisms of interest, rather than to generate field-like failures. This suggests that the integration of the effects of various processes be left explicitly to the predictive model. In this view, the ideal laboratory test is not one that mimics the real world in "fast time," but one that gives information on the rate of a particular degradation process in a rational and quantifiable way.

Application and Environment

Specification of the application and the expected exposure conditions provide

> ... *The real issue is not replacement of service performance evaluation by laboratory testing, but rather of integration of information from different techniques and approaches to achieve reliable life prediction* ...

boundary conditions for service life prediction. These are the "where" and "how" questions of material usage. Design, process, and exposure must be defined. The nature of the prediction required also must

standing of fundamentals coupled with a predictive model may allow the effect of process on structure, and hence, of process on performance to be defined with only indirect reference to performance testing. The

the complexity of the corrosion phenomenon and the number of interacting processes contributing to degradation. It may also be that additional environmental factors or fundamental processes contributing to the corrosion degradation process have yet to be taken into account and need to be incorporated into the predictive scheme.

The specific list of properties or fundamentals to be addressed is dependent on the nature of the proposed application, the intended service environment, and the likely modes and mechanisms of failure. The background information required to make the appropriate selection results from an initial consideration of field and laboratory performance and an evaluation of the application and service environment. The scheme in *Figure* 1 suggests several areas of material characterization and fundamental mechanistic evaluation. The list given is directed primarily toward evaluation of corrosion performance, but even so is representative rather than comprehensive.

> *. . .A carefully crafted model is required to bring all aspects of the service life prediction together. The specifics of formulating a predictive model are dependent on the application, material, and phenomena of interest. . .*

be defined. For critical applications, the onset of failure (earliest failure) under any exposure may be required. More commonly, information about mean or median time to failure (and some measure of variability) under worst case or near worst case conditions may be more appropriate.

Specification of the environment is critical to the formulation of a predictive model, but in practice is often not well understood and not well quantified. Many factors are involved: temperature, humidity, light intensity, and mechanical loading (stress) are some of the variables of concern for coatings. Many corrosion durability and weathering tests for coatings rely on extended continuous exposure to conditions defined at—and sometimes well beyond—the extremes of "real world" exposure. What such test methods miss is the interplay between exposure factors, and the potential importance of the sequence of exposure events.

As an example, corrosion testing of painted galvanized steel under continuously wet conditions results in unrealistically early failures. Painted galvanized steel can give performance inferior to comparable painted coil-rolled steel in salt spray testing, in direct contradiction of field experience. Interspersing dry periods during corrosion exposure tends to bring the laboratory results into line with field performance history.[4] Properly designed experiments can overcome some of these problems, but extensive testing (some of it non-routine) and careful statistical analysis of results are required.[7]

Design and process issues cannot be ignored in formulating predictive models. Design considerations play a critical role in corrosion protection.[8] In the case of automotive corrosion prevention, for example, considerations of points of entry and entrapment of corrosive elements are especially important. Process variables affecting surface pretreatment and paint quality also must be carefully controlled.

The dependence of material performance on process variables can be especially difficult to assess on a timely basis. An under-

effect of variations in cure schedule on crosslinked network structure has been modeled for example. Since there is a straightforward dependence of many performance parameters on network structure, at least some of the effects of variations in cure schedule on performance can be assessed.[9]

Material and System Fundamentals

Fundamental studies play a key role in defining and using predictive models. Indeed, the approach to testing and material evaluation suggested here is based on the notion that the prediction of service life must be based on a fundamental understanding of the processes leading to failure. The tough part is deciding what to study. Failure processes can take many forms, so the complexity and depth of the fundamental and mechanistic characterization needed can be expected to vary widely.

The evaluation of paint weathering through early detection of photodegradation processes[10] is an example of a fundamental measurement that plays a key role in a predictive method. In this case, the key is not so much the particular technique or measure that has been used as it is the notion that the observed physical failure is a direct manifestation of an understandable and quantifiable chemical process.

As another example, corrosion rates of unpainted metals in controlled environments can be predicted based on electrochemical measurements. However, the prediction of painted steel performance under natural atmospheric conditions is not so straightforward. There have been many mechanistic studies of corrosion of painted steel over the years, including detailed electrochemical studies, surface analytical examination of failed systems, phenomenological studies of the effects of various corrosion variables on failure rates, and so on.[11] Nevertheless, there has not emerged a commonly accepted predictive method. This may reflect

Predictive Models

Each of the usual approaches to generating rapid service life information—field performance evaluation, laboratory performance testing, and basic mechanistic studies—is incomplete. Evaluation of actual performance "on the job" usually takes too long to be a practical method of generating a service life prediction. In any case, it is difficult to extrapolate beyond the range of conditions and materials studied. In laboratory performance testing, the relative contribution of multiple mechanisms to natural failure processes are likely to be altered and the dominant mechanism of failure may be changed entirely. Laboratory performance tests cannot be relied upon for prediction of service life *except* through reference implicitly or explicitly to a predictive model. Predictive models are inherently grounded

in assumptions about field experience and the fundamental character of degradation processes. It is important to understand these assumptions.

Fundamental mechanistic studies and material characterization are essential to establishing and justifying the assumptions underlying predictive models. They do not, however, by themselves yield a prediction of performance in the absence of a characterization of failure processes and service conditions.

A carefully crafted model is required to bring all aspects of the service life prediction together. The specifics of formulating a predictive model are dependent on the application, material, and phenomena of interest. The central role of the predictive model remains integration of the results of laboratory performance tests, field history, environment, design, etc. into a coherent whole. Reduction to practice of the general concept of a predictive model requires identification of the principle degradation processes, characterization of the application and exposure, and information about material performance.

Concluding Remarks

Clearly, it is possible to achieve a reasonable comparison of materials performance without a formal consideration of a model, explicit formulation of the fundamentals of degradation, or detailed analysis

of the environment. All of these are at least implicit in a prediction of service life. The utility of the predictive model concept is the framework that it provides for assessing the importance and relevance of the information that is available and the insight it may give on what may be missing from the evaluation of a given material or application.

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(9) Bauer, D.R. and Dickie, R.A., in "Computer Applications in the Polymer Laboratory," Provder, T. (Ed.), American Chemical Society, Washington, D.C., 1986, pp 256-274; reprinted in Bauer, D.R. and Dickie, R.A., "Development and Application of Network Structure Models to Optimization of Bake Conditions for Thermoset Coatings," JOURNAL OF COATINGS TECHNOLOGY, *58*, No. 738, 41 (1986).

(10) Bauer, D.R., Gerlock, J.L., and Dickie, R.A., *op. cit.*

(11) See, for example, Dickie, R.A. and Floyd, F.L., in "Polymeric Materials for Corrosion Control," Dickie, R.A. and Floyd, F.L. (Eds.), American Chemical Society, Washington, D.C., 1986, pp 1-16, and other papers in the same volume.

Society Meetings

BALTIMORE .... MAR.

"VOC"

Technical Committee Chairman Mary Somerville, of Bruning Paint Company, presented a talk entitled, "VOC—WHO CAN TELL THE DIFFERENCE?"

The purpose of the study was to measure the public's perception of the performance of a New York/New Jersey compliant alkyd gloss enamel versus a noncompliant alkyd gloss enamel. A detailed explanation of the paints was followed by the results of brushability, odor, flow and leveling, and gloss tests.

In conclusion, Ms. Somerville stated that, in general, the perception was that there was little difference between the properties of a low VOC enamel and a standard enamel.

Q. What are the list prices of the two enamels in the study?

A. The non-VOC compliant enamel was approximately $20/gallon, and the VOC-compliant enamel was about $30/gallon.

JOHN KURNAS, *Secretary*

CHICAGO .... MAR.

"Mixing Fundamentals"

The meeting's speaker was Steve Bauer, of Mozel, Inc., whose subject was "MIXING FUNDAMENTALS FOR LAB AND PRODUCTION."

The speaker said that scale-up and modeling can be used to study and understand the correlation of mixing processes in the lab and production. Mr. Bauer discussed the parameters used in quantifying scale-up. He said that by using these parameters, the lab and production departments are able to achieve comparable results.

CLIFFORD O. SCHWAHN, *Publicity*

LOS ANGELES .... MAR.

Past-Presidents' Night

The former Society Presidents who attended the meeting included: Alan U. Hershey, 1961-62; Walter K. Barber, 1963-64; William H. Ellis, 1971-72; Johnny Gordon, 1973-74; Robert A. McNeill, 1974-75; Kenneth J. O'Morrow, 1975-76; Robert F. Koperek, 1977-78; Fred Croad, 1978-79; Donald I. Jordan, 1980-81; Jan P. Van Zelm,

1981-82; Romer Johnson, 1982-83; Michael Gildon, 1985-86; Ray DiMaio, 1987-88; and James F. Calkin, 1990-91.

Environmental Committee Chairman Dave Muggee, of E.T. Horn Company, talked about California Storm Water Runoff Permits. He said a group monitoring program of storm water runoff is allowed by the California Water Quality Control Districts.

Also, Mr. Muggee reported on the recent SCAQMD meeting regarding VOC reductions from manufacturing facilities. The 6% annual reduction of VOC emissions can be achieved on a facility-wide basis; reduction on every piece of equipment will not be required.

The technical speaker was Edward W. Orr, of BYK-Chemie USA. Mr. Orr's topic was "IMPROVEMENT OF CORROSION RESISTANCE OF ORGANIC COATINGS WITH WETTING AND DISPERSING ADDITIVES."

A search for environmentally acceptable alternatives to corrosion inhibiting pigments, such as zinc and strontium chromate, was described. The speaker stated that the simple replacement of chromate with a nonchromate pigment does not create the best primer formulation; optimization of the wetting and dispersing system is necessary to create a coating with acceptable resistance properties.

Mr. Orr discussed the mechanism for improving the corrosion resistance of lead and chromate pigments.

He stated that the additive forms a complex with metal substrate, corrosion inhibiting pigment, and coating resin. He said the most effective additives are either anionic or electroneutral in chemical structure. A discussion of a salt spray study of three commercially available modified and unmodified zinc phosphate pigments in a solvent-based air-dry alkyd coating followed.

In conclusion, Mr. Orr said some additives can be classified as having corrosion inhibiting character in themselves. However, in each case, concentration was very important in achieving the best results in salt spray and humidity testing. He stated that a concentration limit of 1.5% on pigment is very important. Also, above this limit, improvement in undercut corrosion may result, but blistering of the coating increases.

Q. Does your additive lower the oxygen/water vapor transportation rate through the coating?

A. Yes. We believe this is the major benefit of the controlled flocculation type of additive.

Q. Is the maximum percentage of additive based on the pigment or on the solids of the total formulation?

A. The level of additive is based on the pigment content.

PHILIP C. BREMENSTUHL, *Secretary*

NEW ENGLAND .... MAR.

"TURA Legislation"

The meeting's first speaker was Rich Bezzero, of the Commonwealth of Massachusetts Toxic Use Reduction (TURA) Division. Mr. Bezzero's topic was "TURA LEGISLATION."

The speaker stated that TURA's goal is to reduce industry's discharge and hazardous waste by 50%. The program is funded by user fees from companies using chemicals that are listed on the SARA 313 list or the CERCLA list @ $1,100/chemical.

Q. Will there be another increase in the TURA fees?

A. They can only increase the fees once.

Society member Harold Small, of Marblehead Testing Labs., Inc., presented a talk on the "EXPERT SYSTEM."

Mr. Small defined the Expert System as the ability to unite knowledge and reasoning. He said that every Expert System has productivity and profitability as a goal. Also, the various types of systems include technical, production, and formulation.

In conclusion, Mr. Small stated that Expert Systems are the future in that they are designed to increase productivity and support quality and service.

JOANNE MONIQUE, *Secretary*

NEW YORK .... MAR.

"Low VOC Coatings"

Sidney Rubin, of Empire State Varnish Company, Inc., reported that tapes of the February Legislative Update Meeting are available at a cost $75 for members and $100 for nonmembers.

Mr. Rubin is Chairman of the Federation's Environmental Affairs Committee.

New York Society member Rudy Berndlmaier, of King Industries, spoke on "THE EFFECT OF A NOVEL CLASS OF THIXOTROPIC AGENTS ON THE RHEOLOGICAL PROPERTIES OF LOW VOC COATINGS."

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, BAPCO, 1470 Nobel St., Boucherville, Que., J4B 5H3, Canada.

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

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

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

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

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

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

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

ROCKY MOUNTAIN (Monday following first Wednesday—Zangs Brewery, Denver, CO). LOUIS HARTNELL, 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—bi-monthly 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.

The speaker pointed out the problems associated with a single point viscosity measurement when attempting to describe the rheology of a coating. He said that the only way to accurately describe rheology is to show the curve of the change in viscosity with the change in shear rate. Mr. Berndlmaier stated that a coating which has a reduction in viscosity with increasing shear, and then a gradual increase when the shear is removed, is thixotropic and will display good rheological properties. Also, a coating that regains the viscosity rapidly after the shear is removed is pseudo-plastic and will not be able to allow good flow and leveling.

Mr. Berndlmaier explained the properties of the new thixotrope, a polyamide wax.

In conclusion, the speaker said the polyamide wax possesses good leveling, lower application viscosity, ease of incorporation, seed resistance, and the ability to reduce VOC by requiring less solvent than other rheological additives. Also, the polyamide is incompatible with alkyds, urethanes, epoxies, acrylics, and melamines.

Q. What is the effect of the polyamide wax on gloss, adhesion, and intercoat adhesion?

A. There is no effect on gloss or adhesion when compared to other rheological additives. However, there can be problems in the case of heat activated polyamides because of a possible interaction. By the same token, preactivated materials of this nature do not present any problems.

Q. Is there any problems with yellowing?

A. No problems have been detected with most coatings. However, yellowing has been seen in coatings where amines are present. Yellowing is related to the amine value and as the amine value increases, yellowing also increases. This is most often seen in alkyds and, generally speaking, yellowing is thought to be more of a resin related problem.

ARMAND J. STOLTE, *Secretary*

NORTHWESTERN .... APR.

Education Night

Federation President-Elect Colin D. Penny, of Hampton Paint Mfg. Company, and Director of Educational Services Michael Bell, staff member, addressed the membership.

Mr. Penny discussed the structure of the Federation. He stated that the principal role of the Federation is education, and he urged members to attend the Society monthly meetings, since an increased emphasis has been placed on educational activities. Mr. Penny also reviewed the Federation's budget.

Mr. Bell also discussed education and reported on the educational programs cur-

LA PAST-PRESIDENTS—Los Angeles Society Past Presidents in attendance at the March meeting include (from left): Standing: Bob Koperek, Mike Gildon, Bill Ellis, Don Jordan, Romer Johnson, and Ken O'Morrow. Seated: Ray DiMaio, Jan Van Zelm, and Society Honorary Member Clarence Myers

rently in progress at the Federation. In addition, he reported on the work being done by the various Federation committees, including the Educational Coordinating, Technical Advisory, and Manufacturing Committees.

Society member Dr. Marek Urban, of the Polymers and Coatings Department, North Dakota State University (NDSU), presented an up-to-date report on the programs at NDSU. He said the philosophy at the university includes both quality education and continuing education.

According to Dr. Urban, the Polymers and Coatings Department at NDSU has received part of a $3.4 million grant to the state of North Dakota to sponsor coatings short courses. Also, a $600,000 National Science Foundation grant along with $600,000 from the state will finance a 12,000-sq ft building improvement.

Dr. Urban said that scholarships and summer research programs are being offered by NDSU at both the undergraduate and graduate level.

In conclusion, he stated that a new faculty position, sponsored by 3M Company, has been established for 1993. Also, it was noted that Dr. F. Dowell, of Harvard University, had been named the new Chairman of the Polymer and Coatings Department. Dr. Dowell is scheduled to begin her work at NDSU sometime in August.

The meeting's final speakers were Tim Willman and Steve M. Carlson, of Valspar Corporation. They discussed the the reality of the coatings business.

Mr. Willman, a graduate of Eastern Michigan University (EMU), began his career at a small company prior to joining Valspar. He stated that he knew the mechanics of coatings manufacture upon graduation from EMU. However, it was necessary to learn the "black art" of coating development first hand. He said that learning from more experienced chemists is instru-

mental in becoming successful in the paint and coatings profession.

Mr. Carlson, a graduate of NDSU, said he had no previous experience in the paint and coatings industry prior to beginning his career with Valspar. He noted that what he learned at NDSU could be applied in industry. In conclusion, Mr. Carlson emphasized that industry experience is beneficial and he encouraged students to apply for internships.

SARAH E. OEBSER, *Secretary*

PHILADELPHIA ....DEC.

"Corrosion Testing"

Thomas G. Brown, of Consultants Consortium, Tech Data Base Subcommittee Chairman, reported on the subcommittee's progress. He said that eight of the 30 editors had completed their portion of the project and the remaining 22 editors were waiting for the return of needed information from the suppliers.

Cleveland Society member Russell C. Raymond, of The Q-Panel Company, gave a talk on "IMPROVED CORROSION CORRELATION: PROHESION COMBINED WITH QUV FOR TESTING RESISTANCE TO SALT, MOISTURE, AND UV."

A comparison of the conventional salt-spray method of testing versus new combinations of testing, the reasons for wet/dry cycling, the proper choice of electrolyte, UV symptomatic damage, and how UV damage accelerates corrosion were discussed.

A detailed explanation of the traditional method of testing, which consists of a continuous fog of hot sodium chloride solution, was presented. He reported on the Prohesion test method which involves a one-hour wet treatment, then a one-hour dryoff period. The fog is at ambient temperature and the

dryoff is at an elevated temperature. Also, the electrolyte solution is modified to better approximate exterior exposure.

Mr. Raymond then discussed wet/dry cycling and UV exposure on corrosion. He used a slide presentation to illustrate test panels exposed using the wet/dry cycling method and compared them to salt spray exposure. Also, some electromicrographs which illustrated data on the mode of failure by analyzing the types of corrosion products were displayed.

Q. Has there been any attempt to combine the two tests into one piece of equipment?

A. Not at this time. Attempts have been made as far back as the 1950s to place fluorescent lamps in the salt spray cabinet. However, as far as I know, the approach was unsuccessful.

Q. Has cycling been used in the testing of coatings for the automotive industry?

A. Cycling is being promoted, but as of yet it hasn't been accepted as the preferred test method. Varying the electrolyte also serves more accurately to test the parts coated for under the hood and on the undercarriage of the car.

BRIAN O'CONNOR, *Secretary*

## PHILADELPHIA ....JAN.

"Environmental Update"

The speaker for this evening's joint meeting with the Philadelphia Paint and Coatings Association was Hugh M. Smith, of Sun Chemical Corporation. Dr. Smith's presentation was entitled "ENVIRONMENTAL UPDATE: WHAT'S HOT AND WHAT'S NOT."

The talk focused on the status of legislation on Capitol Hill and the activities of the EPA and OSHA which will impact the paint and coatings industry in the next year.

CHICAGO MARCH SPEAKER—Steve Bauer discusses "Mixing Fundamentals" at the Chicago Society March meeting
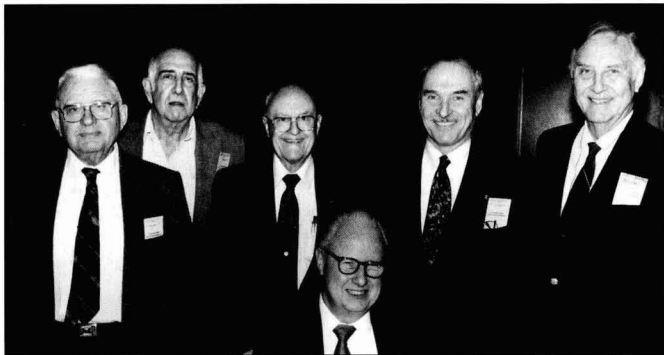
FORMER SOCIETY PRESIDENTS—Participating in the Los Angeles Society Past-Presidents' night are (from left): Fred Croad, Alan Hershey, John Gordon, Robert McNeill, Jim Calkin, and Walt Barber

Letters to the Editor

Let's Not Allow Gallows Birds to Just Flutter Away

The membership list and addresses of the Gallows Birds are ancient. I am writing this letter in hopes of reaching each and every one of you.

There is another reason for updating you, our members, in this fashion: our funds are minimal, and a full-fledged mailing certainly would deplete our treasury.

As you know, this organization—the membership list of which reads like a "Who's Who" of the industry—was begun during the early years of World War II. A lot has changed since then, and to continue this "Gallows Birds" legacy, a total metamorphosis is required.

Let me update you on our present situation. The membership list is out of date to such an extent that an accurate account is impossible to achieve—incorrect addresses, deceased members, etc.

Our by-laws date back to 1943, with no revisions since. A complete overhaul of those by-laws is necessary, probably including, if not replacing, the aspects of federal and military specifications with environmentally compliant materials.

In short, we should come to grips with the present condition within the scope of our industry.

The financial condition of this organization is in dire shape and again, if we are to continue this legacy, we must raise dues. The current $5 annual dues would have been sufficient in the 1940s, but will not cut it in today's economy.

A new slate of officers also needs to proceed forward. At this time, there are only a few who keep the group alive, with no one officially installed.

It would be a shame if this illustrious group faltered. Therefore, anyone wishing to see a revival of the Society of Gallows Birds is asked to write to me with comments, suggestions, and, most of all, a willingness to participate or run for office. If you are a current member and would still like to participate, please send me your name and address.

I will send a copy of the by-laws if it is requested.

Jan P. Van Zelm
Keeper of the keys (temporarily)
BYK-Chemie USA
31662 N. Hipshot Dr.
Castaic, CA 91310
(805) 257-4077

> **Address letters to,**
> **Editor**
> JOURNAL OF COATINGS TECHNOLOGY
> **492 Norristown Road**
> **Blue Bell, PA 19422**

Dr. Smith began his talk with a discussion on pollution in the U.S., and the costs associated with implementing programs aimed at pollution prevention. He said that along with pollution prevention comes four "buzzwords," including: source reduction, getting rid of pollution at its source; recycling, turning waste back into process or into a useable product; treatment, turning hazardous materials into less hazardous ones or nonhazardous ones; and ultimate disposal of hazardous waste, to be used as a final step when all else fails.

The speaker shifted topics and explained OSHA's 1992 policies. According to Dr. Smith, OSHA's first priority is implementation of blood borne infection, or how health professionals could be exposed to AIDS, HIV virus, or hepatitis if the proper precaution are not taken. The organization's second priority is chemical process safety regulations, which includes formalized procedures for working out hazard analysis in processes involving chemicals. A third priority is motor vehicle safety. Fourth, OSHA has proposed a regulation for indoor air quality. The last OSHA priority for 1992 is the media reports on congressional and senate hearings on the need for reform of the OSHA act. A bill which insists that much more power be given to organized labor via safety committees and rights that have not been given previously has been written.

In addition, Dr. Smith stated that fines for workplace violations have increased considerably. He said that the fines are at least seven times more then they were previously.

The speaker discussed the American Disabilities Act (ADA) which went into effect on January 1 of this year. This act outlaws continued discrimination against a job applicant simply because he or she happens to be handicapped. Dr. Smith explained that, as of mid-year, any disabled person must be considered qualified for a job if he/she can perform the job description with "reasonable accommodation by the company."

EPA efforts to characterize effluent from the pigments industry, to decide if the effluent is hazardous or nonhazardous, was explained. According to the speaker, the pigment industry and EPA are working together on the effluent program.

Dr. Smith's final topic was the restriction of the levels of lead, mercury, cadmium, chromium, and products for packaging. The legislation reads that packaging components may only contain so many parts per million of these materials. He said that the National Paint and Coatings Association has petitioned the Council of Northeastern State Governors for relief, however, nothing has materialized to date.

In conclusion, Dr. Smith suggested that industry consider targeting products, processes, and packaging as being environmentally friendly.

BRIAN O'CONNOR, *Secretary*

Elections

BALTIMORE

Active

Maule, Michael L.—W.R. Grace & Co., Baltimore, MD.

McGill, Patrick D.—J.M. Huber Corp., Havre de Grace, MD.

Sheikh, Muhammad Saied—Bruning Paint Co., Baltimore.

Webb, Art A.—Ocean City Research, Arlington, VA.

Associate

Cowans, John R.—Genstar Stone Products Co., Hunt Valley, MD.

CDIC

Active

Gordon, Derek R.—Mayco Colors Inc., Hilliard, OH.

Krause, Douglas W.—PPG Industries, Inc., Delaware, OH.

Associate

Hayes, Romy E.—J.H. Hinz Co., Columbus, OH.

CHICAGO

Active

Beverly, Jeff P.—Valspar Corp., Wheeling, IL.

Cai, Rubing—Sherwin-Williams Co., Chicago, IL.

Challa, Roja R.—Sherwin-Williams Co., Chicago.

Cristiano, Michael F.—Rust-Oleum Corp., Pleasant Prairie, WI.

Delles, JoAnne B.—Construction Tech Lab., Skokie, IL.

Faris, Ismail A.—Cargill Inc., Carpentersville, IL.

Gatlin, Noel A.—United Coatings Inc., Kankakee, IL.

George, Mathew—Cargill Inc., Carpentersville.

Goldschnikl, John H.—Tru-Test Manufacturing Co., Cary, IL.

Lexby, Keith—Universal Chemicals & Coatings, Elgin, IL.

Michael, William E.—PPG Industries, Inc., Oak Creek, WI.

Pavesich, Tony R.—Chemical Systems Inc., Chicago.

Rebel, Bill—Construction Tech Lab., Skokie.

Stevens, Gregory E.—Rust-Oleum Corp., Pleasant Prairie.

Thomas, Clyde E.—Carbit Paint, Chicago.

Zalas, Stephan A.—Valspar Corp., Wheeling.

Associate

Cary, William G.—Cary Co., Addison, IL.

Connors, Thomas N.—Milwaukee Solvents, Butler, WI.

Gray, Daniel A. Jr.—Crosfield Co., Joliet, IL.

Heist, Jeffery H.—Rhone-Poulenc, Inc., Mt. Prospect, IL.

Heyes, Stuart G.—Tioxide America Inc., Lisle, IL.

Ianni, Bruce C.—BF Goodrich, Chicago, IL.

King, Nobal E.—Aqualon Co., Lisle.

Lengen, Gerard M.—W.R. Grace & Co., Chicago Heights, IL.

Lewis, Stantoa C.—Kraft Chemical Co., Melrose Park, IL.

Littel, Kenneth J.—ANGUS Chemical Co., Northbrook, IL.

Matheson, Melissa—Pi/Con Chemicals, Flossmoor, IL.

Pluta, Lawrence—Daniel G. Hereley Co., Des Plaines, IL.

Rous, Richard J.—Daniel G. Hereley Co., Des Plaines.

Southerland, Lorrie—Pi/Con Chemicals, Flossmoor.

Springer, Judy—Alcan-Toyo America, Naperville, IL.

Summers, Patricia E.—UOP, Des Plaines.

Van Dyke, David—Pi/Con Chemicals, Flossmoor.

Wrobel, Elizabeth A.—Air Products & Chemicals, Chicago.

CLEVELAND

Active

Boothe, David P.—Lubrizol Corp., Wickliffe, OH.

Corner, William A.—Garland Floor Co., Cleveland, OH.

Currie, James J.—Jamestown Paint & Varnish Co., Jamestown, PA.

Karp, Edmund J.—Lubrizol Corp., Wickliffe.

Kondilas, John T.—Dylon Industries, Middleburg Heights, OH.

Lancaster, Gerald D.—Cuc Industries, Inc., Cleveland.

Okin, Susan—North Olmsted, OH.

Soltis, William E.—Master Builders Inc., Cleveland.

Associate

Campbell, Gerald K.—Du Pont Chemicals, Shaker Heights, OH.

Sheets, Daniel L.—Lubrizol Corp., Wickliffe, OH.

Educator and Student

Boonyodom, Pailin—Case Western Reserve University, Cleveland Heights, OH.

Chen, Fu-Lung—Case Western Reserve University, Cleveland Heights.

Cid, Jose A.—Case Western Reserve University, Cleveland Heights.

GOLDEN GATE

Active

Benedetti, Edward R.—DeSoto Aerospace Coatings, Berkeley, CA.

Chun, Calvin David—Kelly-Moore Paint Co., San Carlos, CA.

Gac, Norman A.—Adhesive Coatings Co., San Mateo, CA.

Henshaw, Robert A.—Hüls America Inc., Pleasanton, CA.

Michal, Gene—Advanced Cardiovascular, Santa Clara, CA.

Norgaard, Lowell J.—Bennett Industries, San Fernando.

Associate

Bammer, James H.—Southern Clay Products, Laguna Beach, CA.

Mancini, Richard—Bennett Industries, San Fernando, CA.

Molano, Herbert—Manufacturing Business Systems, Pasadena, CA.

Olson Neal, Karen—ICI Resins US, Torrance, CA.

Smoot, Felicia—CRU Industries, Inc., Napa, CA.

Educator and Student

Tai, Wen-Chung—University of California, Berkeley, CA.

Zhu, Zhenkang—Santa Clara, CA.

LOS ANGELES

Active

Alexander, Cyriac P.—Behr Process Corp., Santa Ana, CA.

Askren, Dennis B.—Akzo Coatings, Orange, CA.

Erlikhman, Bluma—Altawood, Inc., Upland, CA.

Jaojoco, Romeo S.—McWhorter Inc., Commerce, CA.

Ko, Benito U.—Lilly Industries, Montebello, CA.

McNaughton, Michael P.—Morton International-Bauer Coatings, Los Angeles, CA.

Omar, Ayman A.—Products Research & Chemicals, Burbank, CA.

Rawolle, Franklin M.—Products Research & Chemicals, San Dimas, CA.

Siy, Henry C.—Behr Process Corp., Santa Ana.

Sypowiz, Robert H.—Cardinal Industrial Finishes, S. El Monte, CA.

Associate

Blank, Mel M.—Cleaver, Beck, Blank & Co., Woodland Hills, CA.

Cozzo, Larry—Graco Inc., Los Angeles, CA.

Fakhr, Reza—Farchem Corp., Santa Fe Springs, CA.

Flesch, Ronald F.—Crown Chemical Corp., Chula Vista, CA.

Hellebrand, Robert—Ashland Chemical Co., Santa Fe Springs.

Hinton, Paul—Norton & Son, Inc., Commerce, CA.

Imfeld, Mark A.—Cargill, Inc., Lynwood, CA.

Kelley, Joseph T.—Kelley Equipment Co., Anaheim, CA.

Educator and Student

Nanna, Michael E.—San Luis Obispo, CA.

LOUISVILLE

Associate

Lykins, Joseph—Palmer Supplies Co., Hamilton, OH.

MONTREAL

Active

Graczyk, Tomasz—Sika Canada, Pointe-Claire, Que.

Associate

LeBlanc, Andre—Du Pont Canada Inc., Montreal, Que.

NEW ENGLAND

Active

Adams, Delilah Faye—Monsanto Chemical Co., Springfield, MA.
Honeycheck, Andrew S.—Rohm Tech Inc., Malden, MA.
Kini, Deepak N.—Millipore Corp., Bedford, MA.
Klausner, Cyndi F.—Graphics Technology International, S. Hadley, MA.
Mallalieu, Gary T.—BYK-Chemie, Wallingford, CT.
Miller, Douglas—Flexcon Co., Inc., Spencer, MA.
Pinho, Antonio M.—Benjamin Moore & Co., Milford, MA.
Rohrs, Susannah F.—Rohm Tech Inc., Reading, MA.

Safron, Gary R.—Rohm Tech Inc., Derry, NH.
Tedeschi, Eugene—USCI, Billerica, MA.
Thompson, David L.—California Products, Cambridge, MA.

Associate

Alfieri, Scott T.—White Cross Labs. Inc., Rye, NY.
Driscoll, Kevin R.—Ashland Chemical, Inc., Tewksbury, MA.
Krizan, Jeffrey F.—Kemira Inc., Basking Ridge, NJ.

NEW YORK

Active

Baez, Ralph—Tempil Division, S. Plainfield, NJ.
Biedron, Mark N.—Con-Lux Coatings, Inc., Edison, NJ.
Cliff, Nancy N.—CIBA-GEIGY Corp., Ardsley, NY.
Iskowitz, Michael—M. Grumbacher, Inc., Cranbury, NJ.
Teng, Ganghui—L&F Products, Montvale, NJ.

Associate

Spitzer, Ronald R.—Troy Corp., E. Hanover, NJ.

Tavares, Bruce A.—Summit Precision Polymers Corp., Fort Lee, NJ.

NORTHWESTERN

Associate

Meier, David B.—Votech Inc., Elgin, IL.
Roberts, James A.—Chem-Serv of Illinois, Chicago, IL.
Stanton, James M.—Experience Inc., St. Paul, MN.

PIEDMONT

Active

Bailey, Philip E.—Sandvik Rock Tools, Bristol, VA.
Collins, Martha J.—Union Carbide Corp., S. Charleston, WV.

Associate

Patel, Arvind J.—Piedmont Converting, Lexington, NC.
Valentin, Hector M.—Union Carbide Corp., Charlotte, NC.
Warnke, David A.—Air Products & Chemicals, Charlotte.
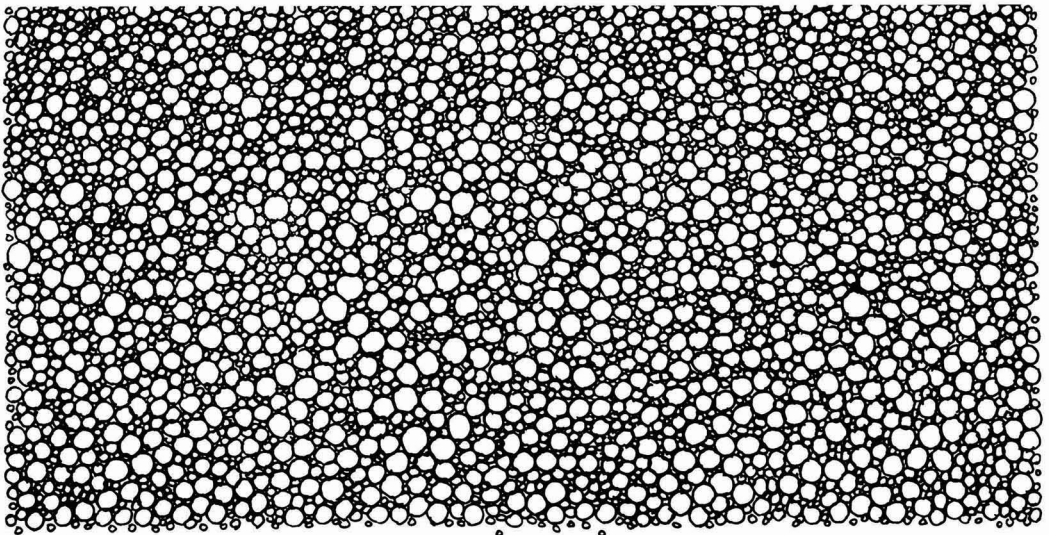
People

The position of Western Region Sales Manager for Troy Corporation, East Hanover, NJ, has been accepted by **James F. Mullowney**. Based in Mission Viejo, CA, Mr. Mullowney will oversee the sales of Troy's biocides and performance additives for customers in the western United States. His sales region includes California, Oregon, Washington, Arizona, Nevada, Utah, Colorado, New Mexico, and El Paso, TX. He will also service Idaho, Montana, Wyoming, North Dakota, and parts of South Dakota and Nebraska. Mr. Mullowney is a member of the Los Angeles Society.
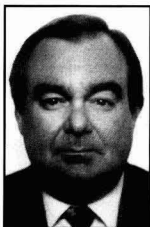
J.F. Mullowney

Air Products and Chemicals, Inc., Allentown, PA, has named **Frederick W. Fisher** Vice President and General Manager/Chemicals for Air Products Asia. In this position, Mr. Fisher will be responsible for managing the company's existing chemicals business in Asia and for developing new chemicals-related opportunities for the company throughout the region. He will be based in Tokyo, Japan.

ISK Biotech Corporation, Mentor, OH, has announced the following appointments within its Industrial Biocides Division: **Hans A. Schroeder**—District Sales Supervisor/Alabama and eastern Mississippi; **Lance E. Johnson**—District Sales Supervisor/West Virginia, Pennsylvania, Maryland, New Jersey, New York, Connecticut, Massachusetts, Vermont, New Hampshire, and Maine; **Coleman M. Allen**—District Sales Representative/western Mississippi, Arkansas, Texas, Louisiana, Oklahoma, and Kansas; and **Doris "Lynn" Welch**—Sales Secretary.

Roger W. Adams and **Charles E. Bunch** have been named Vice President and General Manager, respectively, of Architectural Finishes for the Coatings and Resins Group of PPG Industries, Inc., Pittsburgh, PA.
Richard Q. La Fond, Vice President of Architectural Finishes since 1989, left the company in February.

Southern Clay Products, Inc., has named **John M. Mason** as Director of Sales and Marketing Worldwide. In this position, Mr. Mason will be responsible for the promotion and sales of all of the company's products throughout the world. He will be based in Luton, England.

ICI Resins US, Wilmington, MA, has announced the reorganization of its marketing and sales personnel. The changes include the following: **Robert J. Seidewand**—Business Manager/Industrial Coatings, Wilmington; **Gary C. Warehime**—Business Manager/Trade Sales Coatings, Wilmington; **Susan M. Anderson**—Business Manager/Graphic Arts and Adhesives, Wilmington; **Cliff Tishler**—National Sales Manager, Wilmington; **William Otterbein**—International Sales Manager Wilmington; and **William Ryan**—Western Regional Sales Manager, Chicago, IL.
Mr. Seidewand is a member of the New England Society.

Datacolor International, Lawrenceville, NJ, has named **Phil Jannetto** Area Sales Manager for the company's Mid-West Region. Mr. Jannetto's responsibilities will include managing the Datacolor's Chicago Technical Center, directing regional field sales representatives, and providing coordinated, in-depth customer application and technical support services.

P. Jannetto

X-Rite, Inc., Grand Rapids, MI, has announced the appointments of sales representatives for its color & appearance products. **Norm Uress**, of Advanced Color Technologies, is the new Midwest Representative in Illinois, Iowa, Wisconsin, and Minnesota. **Ron Cronise**, of Eastern Scientific, Inc., has been named East Coast Representative covering the mid-Atlantic states to New England. **Mark Georgantas** and **Lew Shaefer**, of Total Control Systems, are the new West Coast Representatives in California, Nevada, Oregon, Washington, and Colorado.
Mr. Georgantas is a member of the Los Angeles Society.

The Dexter Corporation, Waukegan, IL, has honored several employees from its worldwide locations who won technology innovations and patent awards. Among the recipients honored, five are employees of Dexter's Waukegan facility, one is from the company's Japan-based joint venture, and one employee is from Dexter Packaging-Europe, in Tournus, France.
Winners of Innovation Awards were: **Nobuaki Sano** (Japan), and **Frank L Roccasalva** (Waukegan). Honorable Mention Award winners included: **Georges Sion** (France) and **Vinson Brown**, **Harold F. Cole**, **Peter J. Palackdharry**, **Lawrence P. Seibel**, and **Gary E. Wells** (Waukegan). **Harold F. Cole** (Waukegan) was the recipient of a 1991 Patent Award.

Hüls America Inc., Piscataway, NJ, has appointed **Klaus Burzin** Vice President of its newly formed Coatings Raw Materials and Specialty Polymers Division. Dr. Burzin previously served as a General Manager for R&D and Technical Service, Coatings Raw Materials, and Dispersions, at Hüls AG in Marl, Germany. He has been with the company since 1971.

Federation Anniversaries

25-Year Members
Montreal Society
RICHARD W. MURRY—Canadian Paint & Coatings Association.

50-Year Members
Chicago Society
GERALD G. KRAFT—Kraft Chemicals, Inc.

Montreal Society
GEORGE BERNARD—J. MacFarlane & Son Ltd.

New York Society
WILLIAM L. LAWRENCE—Retired.
CARLTON H. ROSE—Retired.

Northwestern Society
EDWARD W. ERICKSON—Retired.
LOWELL F. WOOD—Retired.

Philadelphia Society
EUGENE H. OTT—Retired.

Violet Stevens has accepted the promotion of Development Associate Scientist/ Coatings and Binders for Dow Chemical USA, Midland, MI. In this position, Ms. Stevens will continue her product development work on high-performance binders for architectural coatings. She has been with the company since 1967. Ms. Stevens is a member of the Detroit Society.

Obron Atlantic Corporation, Painesville, OH, has announced a number of key management promotions and organizational changes based on a general corporate restructuring. The changes include: **Jon Fisher**—President; **Peter Olley**—Vice President/Sales and Marketing; **Tom Adamo**—Vice President/Finance and Administration; and **Paul Brooks**—Industry Manager/Printing Inks.

Additional changes and promotions include: **Denise Clayton**—Customer Service Supervisor; **Jackie Trobenter**—Administrative Assistant; **Debbie Seese**—Export Documentation Specialist; **Phyllis Fisher**—Purchasing Agent; **Cindy Kincaid**—Plant Accountant; **Dave Cooper**—Traffic Manager; **Larry Braden**—Second Shift Supervisor; and **Skip Krug**—Third Shift Supervisor.

Angela S. Pitcock has accepted a position as an Air Quality Engineer/Southeast Region for RMT, Inc., Greenville, SC. Ms. Pitcock will represent clients in regulatory agency matters regarding permit strategies and requirements. She will work out of the company's Nashville, TN, branch office.

Tom Kelliher has joined the staff of McWhorter, Inc., Carpentersville, IL, as its Sales Service Manager. In this newly created position, Mr. Kelliher will be addressing customer needs including supply and distribution, samples, and customer service. He will also oversee business management and administration.

Also, the promotion of **Doug Smith** to Director of Total Quality has been announced by McWhorter. In this capacity, Mr. Smith will coordinate purchasing, product quality, supplier certification, and quality training.

T. Kelliher   D. Smith

AIR PRODUCTS PRESENTS SALES AWARD—Air Products and Chemicals, Allentown, PA, honored S.P. Morell and Company with "Sales Agent of the Year" award for outstanding sales performance in 1991. Pictured in photo, from left, are Sam Morell, President of S.P. Morell, and Dave Warnke, Eastern Regional Sales Manager of Air Products

The recent addition of **Gregrey Diederich** to the sales force of The M.F. Cachat Company, Cleveland, OH, has been announced. Mr. Diederich was previously employed by Diversichem, Inc., where he served for three years as Vice President/ Sales. He is a member of the Detroit Society.

Rheometrics, Inc., Piscataway, NJ, has appointed **Kim Ahmed** Sales Engineer/ Southeast District (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee). Prior to joining Rheometrics, Mr. Ahmed was a Sales Engineer with Instron's software subsidiary, Laboratory Micro Systems, in Atlanta, GA.

David Leyland, formerly with the Maine Department of Transportation, has joined the staff of KTA-Tator, Inc., Pittsburgh, PA, as a Coatings Consultant. In this capacity, Mr. Leyland will perform coating failure analysis services, generic coating system recommendations, specification writing, and other related tasks. He brings over eight years of coatings-related experience to this position.

The National Board of Registration for Nuclear Safety Related Coating Engineers and Specialists, Leola, PA, has approved the appointment of **Dean M. Burger** as Executive Director. He replaces **Al Levy** who passed away in December. Mr. Burger brings to this position over 25 years of experience in coating specifications and technology.

Joe C. Strickland has been appointed President of Amoco Foam Products Company, Atlanta, GA. He replaces **John W. Giroux** who has accepted a special assignment which will be announced at a later date. Mr. Strickland has been with Amoco Production Company since 1969 and he most recently served as President of Welchem, Inc., a subsidiary of Amoco Chemical Company.

The National Decorating Products Association (NDPA), St. Louis, MO, has selected **Ernest W. Stewart** as its new Executive Vice President. Mr. Stewart, who has directed the association's market research activities for more than 10 years, has succeeded **Robert E. Petit**, who has held NDPA's administrative leadership position since 1962. Mr. Petit will continue to serve in a consulting role until his retirement at the end of 1992.

In addition, NDPA has announced the following appointments: **Ron Robertson**—Director of Membership and Industry Activities; **Teri Flotron**—Promotions Director; **Susan Elliott-Smith**—Public Relations Director; and **Kathy Lambla-Goodman**—Sales Executive/*Decorating Retailer* Magazine.

The Roof Coatings Manufacturers Association (RCMA), Rockville, MD, has promoted **Russell K. Snyder** to General Manager. He previously served as Assistant to the Executive Vice President. In addition to serving as General Manager, Mr. Snyder will operate separately as Vice President/ Secretary of AMG/Washington, Inc., RCMA's management firm.

Thomas Mulligan has joined the staff of Spraylat Corporation, Mount Vernon, NY, as Product Manager for the company's newly developed non-slip coatings. Prior to this, Mr. Mulligan was Commercial Market Manager for American Abrasives Metals Company in Irvington, NJ.

William Wishnick, Chairman Emeritus of Witco Corporation, New York, NY, has been chosen as the recipient of The Chemists' Club and the Chemical Industry Association's 1992 Winthrop-Sears Medal. Established in 1970, the Winthrop-Sears Medal recognizes an individual who, by his or her entrepreneurial action, has contributed to the vitality of the chemical industry and the betterment of mankind.

Obituary

Loren B. Odell, Federation 50-Year Member and Honorary Member, died April 9, 1992. He was 79 years old.

Mr. Odell was a graduate of North Dakota State University. After 42 years of service in the coatings industry, he retired on January 31, 1978, from the Napko Corporation, but continued to be an active technical consultant for all phases of the coatings field. During his long industry involvement, Mr. Odell had experience as a Technical Administrative Manager (Napko), President (James Bute Company), a Technical Director, Research Director, Plant Manager, and Technical and Sales Service Representative. He was active in the installation of paint plants, the establishment of laboratories, in the directing and training of technical personnel, and in the development and marketing of coatings products.

Mr. Odell was an Active member of the Houston Society, where he also was an Honorary Member; the Houston Paint and Coatings Association; the National Association of Corrosion Engineers, the American Chemical Society, the Houston Chamber of Commerce, the Texas Association for Business, the Houston Scientific and Engineering Society, and the Downtown Kiwanis Club.

He is survived by his wife, Doris; son, Randy and his wife, Judy; brothers, Alan and Louis; stepsons, Robert E. and William Price; two grandchildren; and two step-grandchildren.

Richard Woolsey has rejoined the staff of Avecor, Inc., Vonore, TN, as Corporate Accounts Manager. Mr. Woolsey, an employee since 1983, left Avecor in mid-1991 but returned to the firm in February 1992 and was named to this new position. Previously, he had been Regional Sales Manager covering an 11-state territory.

The naming of **Tom Worth** to District Manager of the St. Louis branch of Harcros Chemicals Inc., Kansas City, KS, has been announced. Mr. Worth joined Harcros in 1980 as St. Louis Office Manager and was appointed to a sales position in 1984. Prior to joining the company, he had been employed by Siegel-Robert Plating Company.

CrossLinks

by Earl Hill

No. 48

ACROSS

4. Precursor of lanolin
7. Organism that attacks paint
8. A ketone from dipentene
10. Thermal analysis method (Abr.)
12. A container found in the lab
14. Analytical technique, spectroscopic
15. Any color as long as it's _____
18. Having to do with a color system
19. Kind of a traffic paint
22. Synthetic red dye, F_____
23. Cyclohexyl acetate (Syn.)
24. Rubber masticator
26. To bake (Syn.)
29. To come loose
30. An ancient paint chemist
31. What is a liquid aldehyde solvent?

DOWN

1. Spectroscopic technique used with 14 Across
2. A brownish gray color, art
3. Erlenmeyer's contribution to the lab
5. The arrangement of the components of sunlight, e.g.
6. Referring to a kind of lacquer
7. Used to kill 7 Across
8. Phenolic constituent of cashew nut oil
9. A family of pigments, P_____
11. What is a brown water color pigment?
12. Consisting of two rings (Org. Chem.)
13. Verdigris (Syn.)
16. Extender pigment, silicate type
17. A kind of concrete
20. A metal soap of rosin
21. Needle-like
22. Film defect common in gloss enamels
25. Having to do with wooden strips covering a joint
27. A type of white
28. Waterborne coating vehicle

Meetings/Education

USM Department of Polymer Science Announces Slate of Coatings Short Courses for August

The Department of Polymer Science of the University of Southern Mississippi (USM), Hattiesburg, MS, has released its schedule of three coatings short courses slated for August.

The courses and dates are as follows: "Coatings Science for Coatings Technicians"—August 3-7; "Coatings Science for Coatings Chemists"—August 10-14; and "Formulating Coatings"—August 17-21.

The three short courses will be held at USM's new Polymer Science Research Center. The classes will include daily lectures and question and answer sessions.

The short course director is Dr. Shelby F. Thames, Distinguished University Research Professor and founder and first Chairman of USM's Department of Polymer Science.

The course on "Coatings Science for Coatings Technicians" is designed to provide hands-on laboratory instruction. Lectures will focus on basic principles of coatings design, synthesis, performance, and testing for industrial and trade sales coatings. Laboratory sessions will include instruction in and use of instrumentation and techniques for identifying, testing, and evaluating coating performance.

The "Coatings Technician" class enrollment is limited to 30 participants.

"Coatings Science for Coatings Chemists" will place special emphasis on coatings selection, design, formulation, testing, and durability. Topics will be discussed with the overall objectives of waste reduction and lowering VOCs, and will emphasize latex, high-solids, and powder coatings.

The coatings short course on "Formulating Coatings" is designed to highlight formulation techniques and formulating principles, with special emphasis on economic, VOC-regulatory, and coatings-performance criteria. The influence of formulation variations on physical and chemical properties, application properties, and end-use application will be explored.

The cost of the each course is $975 and includes registration, instruction, reference materials, morning and afternoon coffee breaks, and a reception.

For more detailed information about the three coatings short courses, contact: Shelby F. Thames, Short Course Director, USM, Dept. of Polymer Science, Southern Station Box 10076, Hattiesburg, MS 39406-0076.

To register, contact: Deborah A. Theisen, Short Course Program Coordinator, USM, Dept. of Polymer Science, Southern Station Box 10076, Hattiesburg, MS 39406-0076.

Advanced Technology Courses Set for Winter and Fall of '92

CIE-Europe/Elsevier, Sweden, is sponsoring two advanced technology short courses during the summer and fall of 1992.

The 10th international course program on "Semiconductor Materials Processing & Device Technology," is scheduled for July 13-24, in Singapore; and August 17-28, at the Davos Congress Centre, in Switzerland.

"Microelectronics Technology and Reliability" will be held on July 13-24, in Singapore; April 6-10 and August 24-29, at the Davos Congress Centre; and November 30-December 9, in Cambridge, United Kingdom.

The courses are extensive education programs of five and six courses, respectively, including several short modules on the different technologies.

For more information on the advanced technology short courses, contact Tina Persson, Marketing Mgr., or Gunilla Mårtensson, Marketing Asst., CEI-Europe/Elsevier, P.O. Box 910, S-612 25 Finspong, Sweden.

CALL FOR PAPERS

Symposium on
"Durability of Coatings"

Sponsored by
American Chemical Society
Division of Polymeric Materials: Science and Engineering

April 18-23, 1993
Denver, CO

The American Chemical Society (ACS), Division of Polymeric Materials: Science and Engineering (PMSE) invites all prospective authors to submit papers for a symposium on "Durability of Coatings," scheduled for April 18-23, 1993, in Denver, CO.

The symposium is designed to present and discuss the latest fundamental and applied research results on the appearance, durability, and protective lifetime of coatings.

Papers on the following subjects will be considered: analytical methods; nondestructive testing methods; *in-situ* measurements; testing and evaluation; accelerated aging; characterization of indoor and outdoor weathering environments; structure/property/environment/performance relationships; failure mechanisms; failure modes and effects; photochemistry, electrochemistry, and physical aging; conceptual and physical/chemical models; and service life prediction models.

Short papers will be published in the PMSE Preprint Book. In addition, publication of an ACS Proceedings Book is being considered. An expanded version of each preprint paper will be eligible for publication in the Proceedings Book.

All interested authors are asked to submit preliminary titles by July 1. A 200-word abstract on ACS form is due by November 1, along with a preprint manuscript on PMSE paper. The book manuscript must be handed in by the time of the symposium.

For more information, contact any of the following symposium organizers: Jonathan W. Martin, National Institute of Standards and Technology, Bldg. 226, Rm. B348, Gaithersburg, MD 20879; David Bauer, Ford Motor Co., SRL-E3198, P.O. Box 2053, Dearborn, MI 48121; or F. Louis Floyd, Glidden Research Ctr., 16651 Sprague Rd., Strongsville, OH 44136.

"Promoting Quality Coatings" Theme Highlights
45th Annual Pacific Northwest Society Symposium

The Pacific Northwest Society for Coatings Technology held its 45th Annual Spring Symposium, on April 30-May 2, at The Benson Hotel, in Portland, OR.

The Program Committee Chairman for the annual spring meeting was John Westendorf, of Lipscomb Chemical Northwest.

The theme of this year's technical program was "Promoting Quality Coatings." A total of nine technical presentations were the highlight of the event. The speakers and topics included:

"Effects of Surfactants on Associative Thickeners in Aqueous Solutions"—R.G. Brown, of Aqualon Company;

"Theory and Practice of Organic Pigment Dispersion"—Ted Vernardikis, of Sun Chemical Corporation;

"Formulating Waterborne Silicone Product Finishes"—Jay Adams, of Tego Chemie Service USA;

"Waterborne Thermoplastic Resins for Wood Coatings"—Rick Irizarry, of Reichhold Chemicals, Inc.;

"Low VOC Waterborne Coatings for Wood Based on Nitrocellulose—Acrylic Latex"—Harold Haag, of Aqualon Company;

"Waterborne Wood Coatings"—Andrew Swartz, of Rohm and Haas Company;

"New Types of Titanium Dioxide Pigments"—John E. Hall, of Tioxide Inc.;

"Improved Corrosion Correlation. New Techniques Improve Salt Spray Testing"—Douglas Grossman, of Q-Panel Company; and

"Vynate Emulsion Vehicles for Interior Semigloss Architectural Coatings"—Andrew De Fusco, of Union Carbide.

Chairing the Technical Program Committee was Paul H. Payne, Chairman of the Society's Educational Committee.

The Luncheon speaker was Abel Banov, Co-Publisher/Editorial, of the *American Paint and Coatings Journal*.

The meeting also featured a golf outing, a Cinco de Mayo Festival on board a sternwheeler, a skiing trip, the International Competition, and a Spouses' Program.

St. Louis Joint State Affairs Committee Presents Regulatory Issues Seminar

The Joint State Affairs Committee of the St. Louis Society for Coatings Technology and the St. Louis Paint and Coatings Association sponsored a "Regulatory Seminar," on April 30, at the Embassy Suites Hotel, Riverfront Downtown, in St. Louis, MO.

The seminar addressed the regulatory issues which will have an impact on the paint and coatings industry. Featured during the day were local industry and regulatory representatives who presented information on a variety of compliance topics.

The following subject areas were presented:

"Workplace Safety & Hazardous Materials"—Denver Holt, of the Occupational Safety and Health Administration;

"The Reauthorized Clean Air Act"—Frank Hackman, of the Environmental Protection Agency;

"Industrial Waste Water Discharge Regulations"—Bob Zeman, of the Metropolitan Sewer District;

"Hazardous Waste Generators, Common Violations and Enforcement"—Bob Struckhoff, of DNR; and

"Hazardous Materials Transportation, HM-181"—Ken Baer, of Commercial Cartage Company.

The one-day conference was designed for hazardous materials managers, safety coordinators, shipping managers, operations managers, production managers, laboratory personnel, quality control personnel, and packaging personnel.

World Reknowned Scientists to Headline MACROAKRON '94 Symposium

On July 11-15, 1994 The University of Akron, Akron, OH, will host the international symposium MACROAKRON '94. The event is sponsored by the International Union of Pure and Applied Chemistry.

The conference will be held on the campus of the University of Akron and is expected to attract more than 2,000 polymer researchers from the around the world.

The Chairman of the event's Organizing Committee is Dr. Joseph P. Kennedy, University of Akron Distinguished Professor of Polymer Science and Chemistry.

Scheduled plenary speakers include: Dr. Pierre-Gilles de Gennes, a Nobel Prize-winning physicist, of the College de France; Dr. Helmut Ringsdorf, of the University of Mainz, in Germany; Dr. Andrew Keller, of the University of Bristol, in England, and Toyoki Kunitake, of Kyushu University, in Japan.

MACROAKRON '94 will feature topics such as: new polymerization reactions and reaction mechanisms, complex macromolecular architectures and supermolecular polymers, field responsive polymers, polymers at interfaces, and other state-of-the-art polymer scientific topics.

Additional details on the conference may be obtained from Dr. Joseph P. Kennedy, Chairman of the Organizing Committee, or Cathy Manus-Gray, Symposium Coordinator, at Akron University, College of Polymer Science and Polymer Engineering, Akron, OH 44325-0604.

RadTech Europe Conference Slated for May 2-6, 1993 On Board Cruise Vessel

The Third RadTech Conference is scheduled for May 2-6, 1993, on board the Italian cruise vessel T/S Eugenio Costa. The conference is sponsored by RadTech Europe, the European Association for the advancement of curing by UV, EB, and laser beams.

RadTech Europe '93—Mediterraneo will feature technical papers, seminars, workshops, and poster presentations.

The technical program will address the issues of the next decade, such as the environment, nonpolluting coating/printing technologies, waste and recycling, and safety and health issues.

For additional details and registration information, write RadTech Europe, Business Office, Pérolles 24, CH-1700 Fribourg, Switzerland.

KTA-Tator to Conduct Coatings Training Courses

KTA-Tator, Inc., Pittsburgh, PA, has released its 1992-93 Coatings Training Course schedule.

The KTA courses are three days in length and are conducted on two levels: Introductory and Advanced.

Course topics and dates are as follows:

"Level I—Inspection of High Performance Coatings"—October 20-22, 1992; January 19-21, 1993; March 16-18, 1993; and October 19-21, 1993; and

"Level II—Coatings Failure Analysis"—December 1-3, 1992; February 23-25, 1993; and November 16-18, 1993.

All courses will be held on site at the KTA training facilities, in Pittsburgh.

Literature

Wood Care Guide

A 28-page, five-color "Wood Care Guide" has been printed. The booklet includes colorful, how-to product application photos as well as easy-to-understand application instructions. For further information on how to obtain a copy of the guide, contact The Flood Co., P.O. Box 399, Hudson, OH 44236-0399.

High Purity Acids

A line of high purity acids created to meet the growing demand in environmental analysis for acids with impurity levels in the parts per billion range is the topic of literature. The family of acids includes acetic, nitric, hydrochloric, and sulfuric acids and ammonium hydroxide. For more details on the TracePur™ Plus high purity acids, write EM Science, P.O. Box 70, 480 Democrat Rd., Gibbstown, NJ 08027.

Spectra Kit

The availability of a new educational absorption spectra kit for use in demonstrating the characteristics of light and the absorption process has been announced. The kit contains a transmission diffraction grating, slit mask, petri dish, and a user's manual. For more information, contact Milton Roy, 820 Linden Ave., Rochester, NY 14625.

Feed Systems

An eight-page technical bulletin on filter press feed systems has been released. The publication includes schematic drawings for two types of progressing cavity pump feed systems. A discussion of the various features of the systems is also included. Contact Netzsch Inc., Nemo® Pump Div., 119 Pickering Way, Exton, PA 19341-1393, for more details.

Polyurethane Dispersions

A line of polyurethane water-based copolymer blends designed for architectural and OEM coatings applications has been introduced through a bulletin. Applications for these resins include wood and plastic coatings and metal primers. To receive a copy of a catalog featuring these copolymers blends and other polyurethane products, write K.J. Quinn & Co., Inc., 135 Folly Mill Rd., Seabrook, NH 03874-0158.

Additive

A four-page product information bulletin detailing a slip and anti-mar additive for radiation-cured coatings has been printed. According to the brochure, the surfactant offers a solvent-free alternative for enhancing properties of ultraviolet or electron beamcured coatings based on a wide variety of resins. The bulletin also discusses applications and includes a table of recommended starting usage levels. Copies of the publication on SILWET® Surfactant RC-73, designated SC-1893, are available from Union Carbide OrganoSilicon Products, Systems and Services, Dept. H2375, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Rheometer Software

Rheometer software packages and how they can be used to perform analyses quickly and automatically on rheological and other test data are being highlighted in a new product brochure. The software reportedly controls the rheometer and manages data collection, storage, display, and transfer. The brochure describing RHIOS and RHECALC rheometer software packages is available from Rheometrics, Inc., Marketing Dept., One Possumtown Rd., Piscataway, NJ 08854.

Gas Flowmeter

A four-page brochure outlining a new digital gas flowmeter has been released. The full-color bulletin highlights the instrument's features, maximum range and accuracy, product specifications, and ordering information. To receive a free copy of the "AccuRATE™ 1000 Intelligent Flowmeter" brochure, contact J&W Scientific, 91 Blue Ravine Rd., Folsom, CA 95630-4714.

DSC System

The introduction of an automated differential scanning calorimetry (DSC) system that is designed to provide analysts with increased laboratory productivity and versatility has been made through a data sheet. The system consists of a thermal analyst computer/controller, a DSC 2910 differential scanning calorimeter with autosampler accessory, a laser printer/plotter, DSC autoanalysis software, and an autofill liquid nitrogen cooling accessory. For further details, contact TA Instruments, 109 Lukens Dr., New Castle, DE 19720.

Color Matching Tool

A tool for visual color matching of paints and coatings is the focus of a product release. The viewing booth reportedly offers sample inspection without extraneous light, or reflections from hands and clothing or other surfaces. More technical details on the Atlas Color-Chex™ are obtainable from Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613.

Manufacturing Books/Videos

The Society of Manufacturing Engineers (SME) has announced the availability of its updated *1992 SME Catalog*. The 64-page catalog highlights more than 350 publications and videotapes being offered by the association. Featured publications range from textbooks to handbooks, and reference books to conference proceedings. To receive a free copy of the catalog, write SME, Customer Service Center, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930.

Powdered Antifoam

Technical literature highlights a powdered antifoam designed to be used for compounding with dry mix products like thin-set plasters, dry mix adhesives, cement patching compounds, underlay compositions, joint compounds, as well as paint and spackles. Batch samples and product information on HODAG HC-311 are obtainable by writing Hodag Corp., 7247 N. Central Park Ave., Skokie, IL 60076.

SITUATIONS WANTED

UV Detection

A data sheet outlining a high-sensitivity, dual-channel, programmable UV detector for liquid chromatography in paint and coatings laboratories has been released. The bulletin describes the instrument's features, which includes automatic peak purity determination and ratiograms. For a free copy of the data sheet on the new LC-135C Diode Array Detector, write The Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0012.

Data Interpretation Software

A data sheet outlining data interpretation software for mechanistic studies has been printed. The bulletin offers a technical overview of the software, includes detailed specifications, and illustrates typical plots with screen display photos. For a copy of the data sheet detailing the Condecon line of software, contact EG&G Princeton Applied Research, Electrochemical Instruments Div., P.O. Box 2565, Princeton, NJ 08543.

Resins

Two new outdoor-durable polyester powder coating resins have been introduced through a news release. These saturated, carboxyl-functional polyester resins are reportedly free of trimellitic anhydride. For further information and product samples of Grilesta® V 76-21 and V 76-14, contact Craig Schmehl, EMS-American Grilon, Inc., P.O. Box 1717, Sumter, SC 29151-1717.

Aliphatic Waterborne Urethane Polymers

The introduction of cosolvent free aliphatic waterborne urethane polymers has been made through a product release. The polymers reportedly exhibit excellent adhesion to various substrates, such as mylar, nylon, aluminum, and fiberglass. For further information or samples of SANCURE 861 and 878, write Sanncor Industries, Inc., 300 Whitney St., Leominster, MA 01453.

Viewing Booth

A multiangle viewing booth designed for making visual evaluations of metallic, pearlescent, and other effect surfaces is highlighted in a data sheet. The booth is suggested for making surface evaluations in the automotive, cosmetics, glass, packaging, paint and coatings, plastics, sporting goods, toys, and other industries. Write Macbeth, P.O. Box 230, Newburgh, NY 12551-0230, for further details on the Skylight™ multi-angle viewing booth.

Rheometer

The introduction of a dynamic shear rheometer (DSR) has been made through a data sheet. Targeting the asphalt industry, the DSR is intended to meet and exceed the requirements of the U.S. Strategic Highways Research Program for testing binder performance. For additional details, contact Laura Migliore, Bohlin Instruments, Inc., 2450 Rte. 130, Ste. 113, Cranbury, NJ 08512.

Acrylic Binders

The development of a line of formaldehyde-free acrylic binders for textile, nonwovens, and paper applications has been announced through literature. These self-crosslinking binders and coatings cure at low temperatures and supposedly stand up well to dry cleaning. Write Rohm Tech Inc., 83 Authority Dr., Fitchburg, MA 01420, for more details on the new Rohamer F/F line of formaldehyde and acrylonitrile free binders.

Ethyleneamines

Applications for a line of ethyleneamine products are described in a new 12-page brochure. The four-color publication features descriptions of the following ethyleneamines applications: chelating agents, epoxy hardeners/polyamide resins, wet strength resins, corrosion inhibitors/oil field chemicals, surfactants, fuel additives, lubricating oil additives, and others. For a copy of the brochure entitled, "A World of Possibilities—Dow Ethyleneamines Applications," write The Dow Chemical Co., 2020 Williard H. Dow Center, Midland, MI 48674.

Pigments and Dyes

Pigments and dyes used in coatings, printing inks, plastics, and synthetic fibers applications are the subject of a 64-page publication. The reference book presents physical, chemical, and application properties and is divided into three sections: general characteristics, pigment preparations and special dyes, and applications. For copies of the new "Pigments Guide," contact Chris McCormick, CIBA-GEIGY Corp., Pigments Div., 205 S. James St., Newport, DE 19804.

Reflectance Spectroscopy

A six-page, full-color brochure describing reflectance spectroscopy accessories, calibration standards, reflectance measurement services, and custom reflectance product and measurement capabilities has been issued. For a copy of the brochure, write Labsphere, Inc., P.O. Box 70, North Sutton, NH 03260.

Exterior Primers

Two new water-based exterior primers have been introduced through a newsletter. Recommended uses for the primers are on siding, clapboard, sash, shingles and masonry surfaces including tilt-up and poured-in-place concrete, cement block walls, brick and stucco walls, and mortar joints. Inquiries for additional information should be identified as "A-100® Latex Exterior Wood Primer & Loxon® Exterior Masonry Primer (SWS-3666)," and sent to The Sherwin-Williams Co., c/o HKM Direct, 5501 Cass Ave., Cleveland, OH 44102.

Sampling Kits

Three sampling kits which were developed to assist in the determination of the hazardous content of paint, soil, and abrasive blast cleaning debris have been introduced through a product release. The kits include labeled sample containers, sampling procedures, and Chain of Custody forms. For a free brochure, contact KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275.

Cavity Pumps

A line of progressing cavity pumps designed for pumping materials in harsh environments is the topic of literature. Available in a wide range of sizes, the pumps reportedly have output capacities from 0-1000 gpm and pressure capabilities up to 1000 psi. For further details on the Nemo® NESP cavity pumps, write Netzsch Inc., Nemo Pump Div., 119 Pickering Way, Exton, PA 19341-1393.

Auto Panel Reinforcement

The development of a stiffening compound for automotive body panels has been announced through literature. In addition to apertures where the product has been used in commercial production, applications include hoods, deck lids, roofs, door panels, and floor pans. The compound can be robotically applied by spray or extrusion. Write PPG Industries, 1400 E. Avis St., Madison Heights, MI 48071, for more in-depth details on BPR® body panel reinforcement.

Water Treatment Systems

The introduction of a new line of LED water treatment systems has been made through a product release. All systems are electrically powered and operate by evaporation and condensation of water or non-flammable solvents (depending on boiling point). For more in-depth information, write Robert T. Landers, Distil-Kleen, 22 Hudson Pl., Hoboken, NJ 07030-5512.

Graphics Removal Kit

A graphics removal disc, which is designed to remove vinyl graphics, decals, tapes, films, and adhesive from many surfaces, including painted surfaces, without damaging the paint, is being outlined in a data sheet. The discs are not recommended for use on acrylic lacquer paints, or on polycarbonate and acrylic plastics. Write 3M, P.O. Box 33600, St. Paul, MN 55133-3600, for further details on the Scotch-Brite™ graphics removal kit.

Solvent-Free Paint

An interior latex paint which contains no petroleum-based solvents is highlighted in a product release. The paint reportedly emits no volatile organic compounds as measured by EPA Test Method 24. For more technical information on Glidden Lifemaster™ 2000, contact The Glidden Co., 925 Euclid Ave., Cleveland, OH 44115.
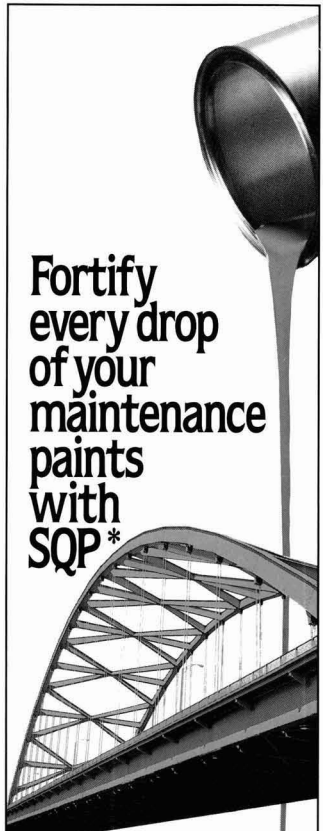
Filtration Products

A 16-page brochure outlining the use of filters in the paint manufacturing process has been printed. The full-color publication, with easy-to-follow, color coded tables, focuses on various cartridge styles, ordering information, removal ratings, and cartridge flow characteristics. To obtain a copy of "The Paint Application Guide (PAG 100)," write Pall Process Filtration Co., 2200 Northern Blvd., East Hills, NY 11548-1289.

NMR Spectrometers

A series of high-performance, high-resolution NMR spectrometers is the focus of a data sheet. Mouse-driven operation with new menus and powerful new icons are just a few of the series features. Contact Bruker Instruments, Inc., Manning Park, Billerica, MA 01821, for further information on the ARX NMR spectrometers.

Performance Additives

A new data sheet highlighting a line of performance additives for coating applications has been released. Additives described in the brochure include the company's lines of Surfynol® surfactants, Metacure® and Amicure® catalysts, Amicure crosslinkers, and Ancor® corrosion inhibitors. For a copy of the publication, "Performance Additives for Coatings," write Air Products and Chemicals, Inc., Performance Chemicals Div., 7201 Hamilton Blvd., Allentown, PA 18195-1501.

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

(June 8-10)—"How to Implement Total Quality Management and Secure ISO 9000 Series Certification." Sponsored by Professional Development Committee. Adam's Mark Hotel, Philadelphia, PA.

(June 11-12)—"Gauge/Measurement Process Assessment and Improvement." Sponsored by Professional Development Committee. Adam's Mark Hotel, Philadelphia, PA.

(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

(Oct. 27-29)—71st Annual Meeting and 58th Paint Industries' Show. World Congress Center, Atlanta, GA.

1994

(Oct. 12-14)—72nd Annual Meeting and 59th Paint Industries' Show. New Orleans Convention Center, New Orleans, LA.

SPECIAL SOCIETY MEETINGS

1992

(June 15)—Golden Gate Society. "Ideas for the Future." Manufacturing Committee Conference. Holiday Inn, S. San Francisco, CA. (Louie F. Sanguinetti, Jasco Chemical Corp., P.O. Drawer J, Mountain View, CA 94042).

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.

OTHER ORGANIZATIONS

1992

(June 14-18)—XXIIth FATIPEC Congress. RAI International Congress Centre, Amsterdam, The Netherlands. (General Secretary Francis Borel, 34 Chemin du Halage, La Bonneville, Mery sur Oise, France).

(June 15-17)—Euroformula '92. International Trade Fair. RAI International Exhibition and Congress Centre. Amsterdam, The Netherlands. (RAI, Europaplein, 1078 GZ, Amsterdam, The Netherlands).

(June 15-26)—"Coatings Science." Short course sponsored by North Dakota State University (NDSU), Fargo, ND. (Jeanette Shaw-Lynch or Deborah M. Shasky, Dept. of Polymers and Coatings, NDSU, Fargo, ND 58105).

(June 16-18)—"Radiation Curing: Ultraviolet Light and Electron Beam Technology." Course sponsored by Center for Professional Advancement. Chicago, IL. (Center for Professional Advancement, P.O. Box H, East Brunswick, NJ 08816).

(June 21-24)—ISCC 61st Annual Meeting and AIC 25th Anniversary. International symposium on "Computer Color Formulation." Princeton University, Princeton, NJ. (Danny Rich, ISCC Secretary, ACS Datacolor, 5 Princess Rd., Lawrenceville, NJ 08648).

(June 24-26)—"Coatings Process Fundamentals." Short course sponsored by Center for Interfacial Engineering and University of Minnesota. Minneapolis, MN. (J.D. O'Brien, Dept. of Chemical Engineering and Materials Science, University of Minnesota, 421 Washington Ave. S.E., Minneapolis, MN 55455).

(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).

(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. 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. (PCI Headquarters, 1800 Diagonal Rd., Suite 370, Alexandria, VA).

(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." Sponsored 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. 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).

(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).

(May 4-6)—Plasticoat '93 Conference and Exhibition. Sponsored by Products Finishing. Drawbridge Estate & Convention Center, Ft. Mitchell, KY. (Cindy Goodridge, Gardner Management Services, 6600 Clough Pike, Cincinnati, OH 45244).

1994

(July 11-15)—MACROAKRON '94 International Symposium. Sponsored by the International Union of Pure and Applied Chemistry. University of Akron, Akron, OH. (Dr. Joseph P. Kennedy, Chairman of the Organizing Committee, or Cathy Manus-Gray, Symposium Coordinator, College of Polymer Science and Polymer Engineering, The University of Akron, Akron, OH 44325-0604).

'Humbug' from Hillman

Apparently, Jay Adams has a sensitive nose for news. Humbug's April column relayed the story that Jay smelled out from the *Detroit Free Press* on the effect of deodorants on the finishing of new Jeeps.

This month he's done it again! Jay sent us a story from the *Orange County (CA) Register*, reported by Michelle Locke of AP. As my grandkids frequently observe, "ich, gross!"

Berkley, CA: "As an avid environmentalist, Councilwoman Nancy Skinner thought an all-natural milk based house paint would turn her home into the picture of ecological correctness.

Three months later, the experience has been more like a brush with disaster, says Skinner, who was driven out of her house when the paint turned putrid, filling the house with the noisome (noxious, disgusting—Ed.) perfume of rotten socks.

'It smelled like really bad compost and body odor all mixed up together,' Skinner told the *Oakland Tribune*, 'It's like about 20 guys were in a room who hadn't taken a shower for weeks.'

Skinner finally had to hire a contractor to tear out the old walls, put in new wallboard, and paint once again—this time with standard synthetic-based paint."

The ridiculous story ends with the paint distributor, a Eugene Dunlop, who imports the stuff (without preservative) from the manufacturer, Auro of Braunshweig, Germany, commenting, " ... what I don't understand is we're supposed to have all the fault!" ... Humbug laughed all the way to the word processor. Justice triumphed!

Jeff Sturm forwarded a copy of a customer's newsletter, the "Yetter Letter" (catchy?) from which Humbug has plucked a story with a double whammy. Jeff and Marty Miller are unknowingly preparing our readers for the horrors to be bestowed by Humbug next month. Ready? ...

A man fell to his death while using his forehead to ring the bell in the Notre Dame Cathedral in Paris. A witness asked the priest who had been in the tower with the deceased what the man's name was. The padre replied, "I don't know his name but his face rings a bell."

Three months later, another visitor, who bore a definite resemblance to the dead man, turned up at the old priest's door with the same request. "That was my brother, John, who died ringing the bell," he informed the priest. "I've come to ring the bell in his honor, if I may."

Once again the old priest led the way slowly up the stairs to the bell tower. Once again the bell ringer was just getting into the swing of things when he pitched forward from the tower to the sidewalk below.

This time a young woman was first to ask, "Father, what has happened up there? Did you find this one's name?"

"No," replied the priest softly. "But he was a dead ringer for his brother." ... Oh come on, we can't win them all!

A consultant hired to improve efficiency in a company immediately called a meeting of the shop person-nel. In stressing the importance of following a set plan, he gave this example: "You are on the Titanic and it is sinking. You find yourself in a lifeboat. It's dark and hazy and you don't know in which direction to row. Now, here you are in the same situation, but you have the navigator with you. Now, you would row the way the navigator told you, right?

A murmur of agreement went through the crowd until one person in the back said, "Well, I don't know. He already hit an iceberg."

—About the only thing a child will willingly share are communicable diseases and his mother's age.

—In some of today's marriages, people still take each other for better or worse—but not for long.

—And this one is timely: A man visited a geneologist and asked how much it would cost to have his family tree traced. "That depends on how far back you want it traced and how difficult it is to search the records. It might cost several hundred dollars or several thousand."

"That sound pretty expensive," the man replied. "isn't there a cheaper way?"

"Oh sure," said the geneologist. "The easiest way to have your family tree researched is to run for public office."

—The Lion

An obviously irate John DeGroat adds to the "Third Biggest Lies,"—"The Congressional Ethics Committee." Say it with a smile, John.

—At a big New Year's Eve party, an attractive matron asked a young man to guess her age. "You must have some idea," she said as he hesitated.

"I have several ideas," he admitted with a smile. "The only trouble is that I can't decide whether to make you 10 years younger because of your looks or 10 years older on account of your charm."

—Two acquaintances met at the entrance of a psychiatrist's office. One asked: "Are you coming or going?"

"If I knew," the other answered, "would I be here?"

—A minister met a friend on the street who admired his umbrella. "Thanks," said the minister, "But I'm not sure that I came by it honestly. It started to rain the other day and I stepped into a doorway to wait until it stopped. Then I saw a young man coming along with a nice large umbrella, and I thought if he was going as far as my house, I'd asked to share it with him. So I stepped out and asked him: 'Where are you going with that umbrella, young fellow?' And he dropped the darn thing and ran.

—He: "There was a time when I could speak Spanish as well as I could speak English.
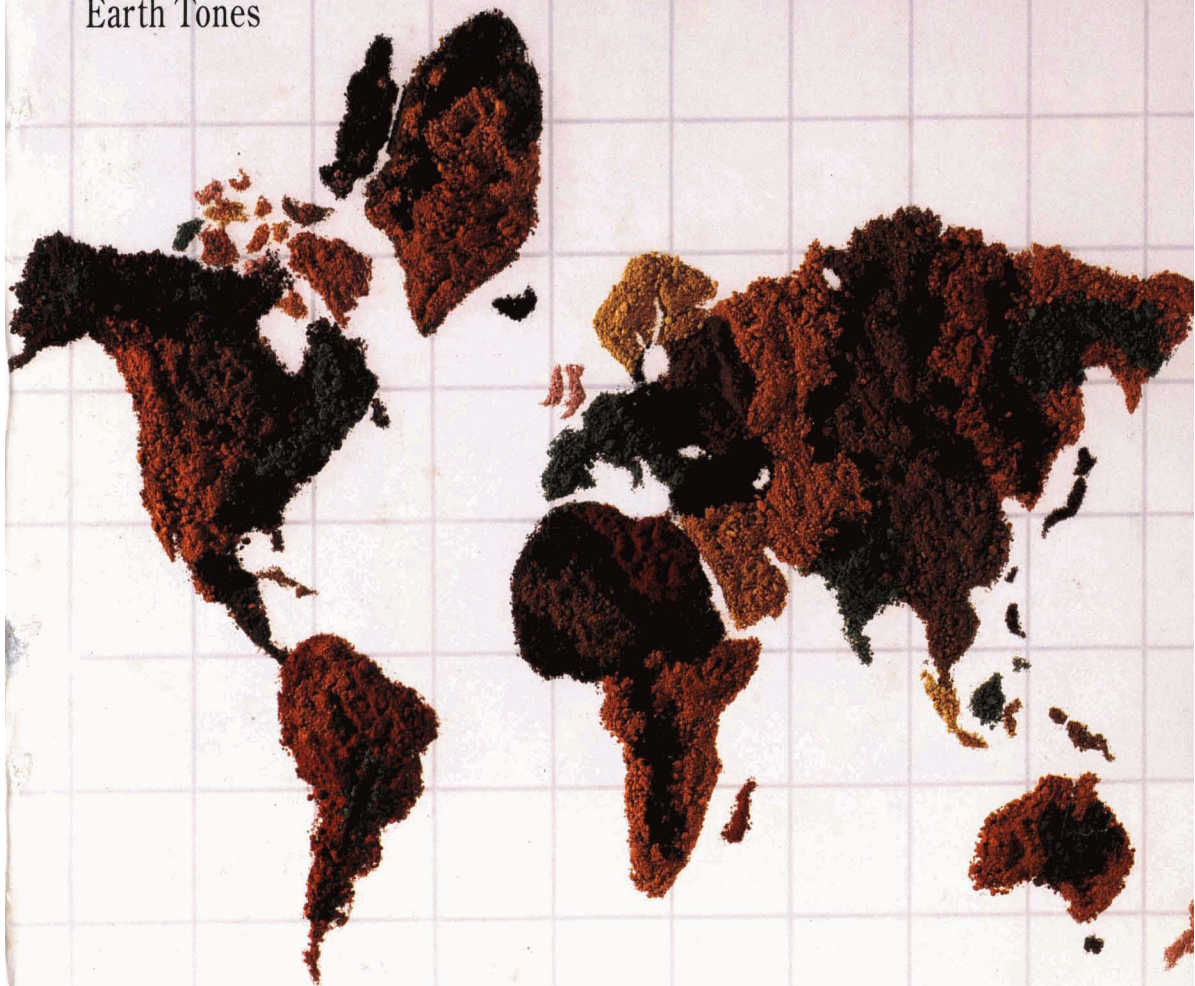
She: "How remarkable."

He: "Well, I guess it really wasn't. I was only a year old at the time."

—Caveman's motto: "I came, I saw, I conked her."
—1978 *Farmer's Almanac*

—Herb Hillman
Humbug's Nest
P.O. Box 135
Whitingham, VT 05361

Earth Tones

Harcros Pigments. Now Appearing All Over the World.

Harcros Pigments now reaches over 165 countries worldwide, with virtually every earth tone possible, for virtually every industry imaginable. From construction to paints to automotive to electronics to ink. When you see earth tones, you see Harcros.

You'll be seeing the exact same thing from us years from now, too. Thanks to our Fine Particle Technology and advanced process controls, Harcros colors remain true and permanent from batch to batch, day to day, century to century. We call it innovation. You call it quality.

So add a touch of Harcros. We give the world its color.

HARCROS
PIGMENTS

Harcros Pigments Inc.   11 Executive Drive, Suite 1   Fairview Heights, IL 62208