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August 1991

JOURNAL OF COATINGS TECHNOLOGY

Gloss of Paint Films and the Mechanism of Pigment Involvement

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SEPTEMBER '91 - Featured are the Preliminary Program of Technical Sessions, floor plan of the show exhibitors, registration forms, housing forms and hotel information, as well as general show information.

OCTOBER '91 - 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 Program of Technical Sessions; floor plan of show exhibitors; an alphabetical list of exhibitors and their booth numbers; a list of exhibitors classified by product/service; and general show information.

JANUARY '92 - This Annual Meeting and Paint Show Wrap-up Issue features information on all exhibitors, with emphasis on products and special booth features; photo displays of award-winning booths; as well as a complete review of important Annual Meeting and Paint Show happenings.

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FSCT 1991

Metro Toronto
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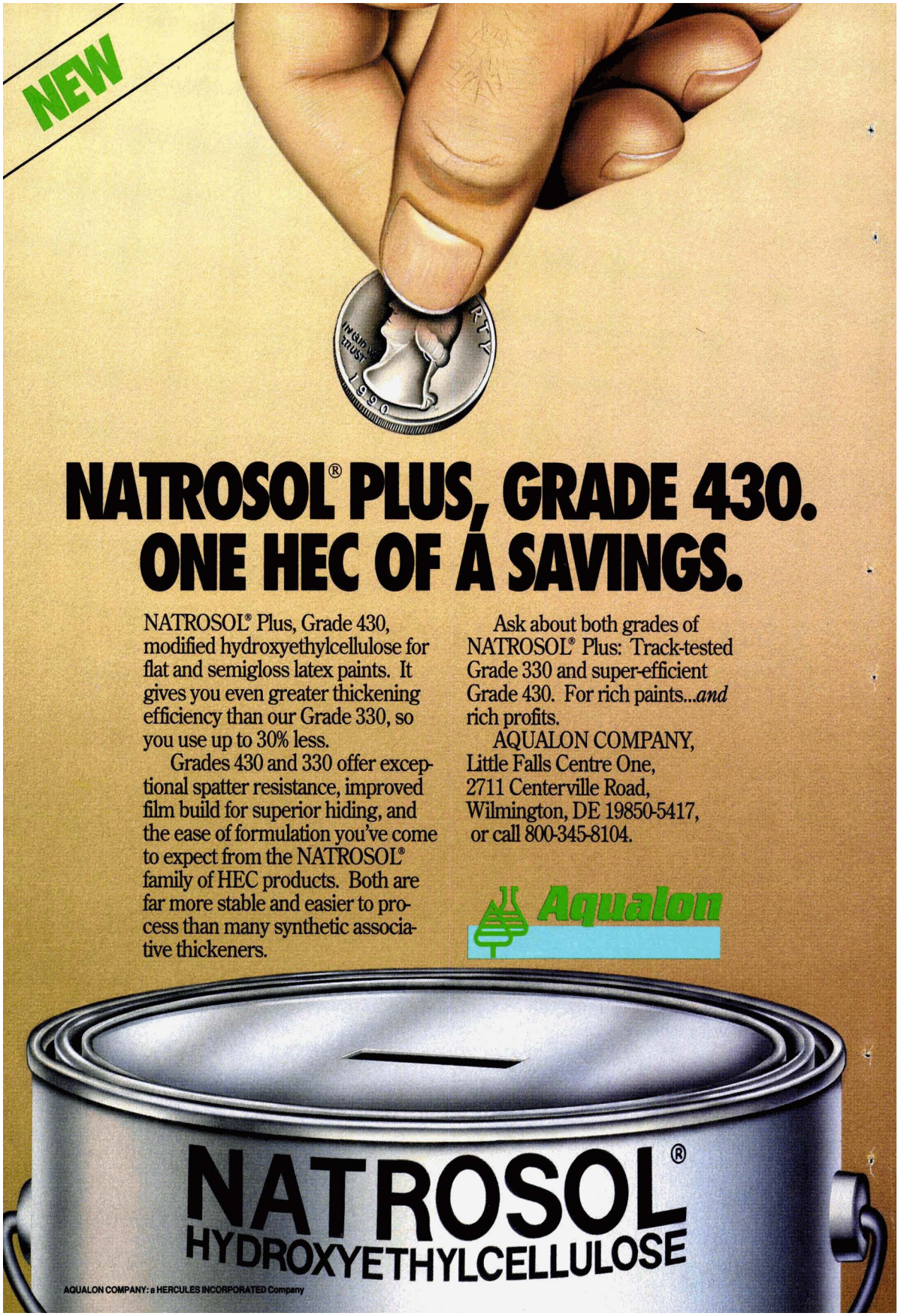
Toronto, Ontario, Canada
November 4-5-6, 1991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AUGUST 1991

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VOLUME 63 NUMBER 799

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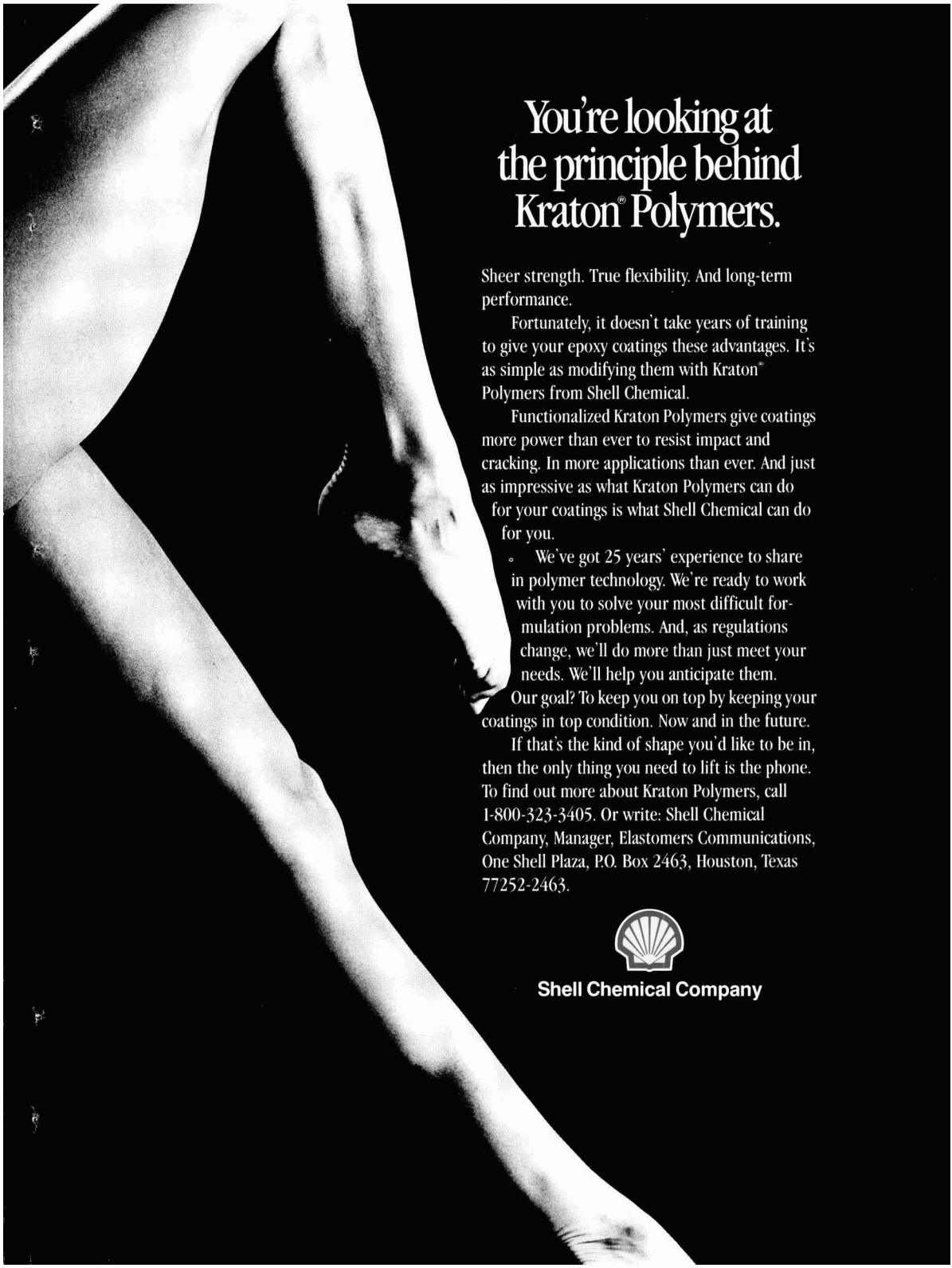

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The Federation of Societies for Coatings Technology assumes no responsibility for the opinions expressed by authors in this publication.

Comment

The State of the Federation

We are pleased to present, within the pages of this issue *(See pages 27-40)*, the 1990 Annual Report of the Federation, in conjunction with the report of the Spring 1991 meeting of its Board of Directors.

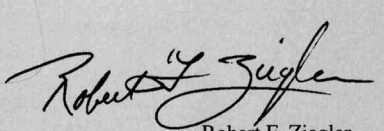
Meeting twice annually, the Board examines and discusses the various programs and projects being conducted by the Federation. In its deliberations, the Board, necessarily, reviews the status of current activities and approves or disapproves of actions taken or proposed by Federation Committees and Staff.

In the past, reports of these meetings have been published for the information of the Federation's membership, as dictated in the By-Laws. However, now that the FSCT has legally incorporated, the reports assume increased importance as Annual Reports and, as such, must contain certain information not included in past years, for example, the 1990 financial statements which were reviewed and approved by the Board at its May 15 meeting.

Also included is detailed information regarding budgeting, membership, publications, the Annual Meeting and Paint Industries' Show, and committee activities. Other items of interest are a report of the Coatings Industry Education Fund and individual reports from Federation Committees.

We urge the membership to read the Annual Report and to pass along comments or questions to either your Society Representatives or the Federation Headquarters.

Remember, this is **your** Federation. The interest of its membership is not just appreciated, but is vital to its "state."



Robert F. Ziegler
Executive Vice President

Abstracts of Papers in This Issue

GLOSS OF PAINT FILMS AND THE MECHANISM OF PIGMENT INVOLVEMENT—J.H. Braun

Journal of Coatings Technology, 63, No. 799, 43 (Aug. 1991)

The optics and the perceptions of gloss are discussed in terms of *intensity-of-reflected-image* and *distinctness-of-image* and an hypothesis is proposed for the mechanism by which pigment degrades the gloss of paint films.

Paint films dry in two stages, separated by what we call a Surface Critical Point. During the first, wetter stage of drying, surface tension dominates and forces the surface of the wet film to remain smooth down to molecular scale. As the film dries, structure develops within. During the second, drier stage, the compressive strength of structure within the drying paint film—its yield stress—exceeds the surface tension, and as the film shrinks, its surface develops the micro roughness that diminishes gloss. The structure within the film is controlled largely, but not exclusively, by flocculation and packing of pigment particles.

The proposed mechanism is supported by paint lore and experimental results in optics, rheology, colloid science, paint practice, and pigment technology.

ANALYTICAL STUDIES OF LIGHT STABILIZERS IN TWO-COAT AUTOMOTIVE FINISHES—H. Böhnke, L. Avar, and E. Hess

Journal of Coatings Technology, 63, No. 799, 53 (Aug. 1991)

Light stabilizers are known for protecting two-coat automotive finishes from the harmful effects of weathering. Such systems are stabilized with UV absorbers in combination with radical scavengers of the HALS type. However, the light stabilizer content in an enamel is reduced during weathering, resulting in negative consequences for light stabilization.

Using the microtome section technique, two-coat automotive finishes were completely removed, layer by layer, in 2 μm sections, which were then analyzed for their UV absorber content. In this manner, exact UV absorber content profiles through the entire coating could be established which permitted important conclusions as to the behavior of the UV absorbers during baking and weathering.

These analytical studies were carried out for different classes of UV absorbers, and various types of two-coat automotive finishes. Analogous examinations were also performed for HALS stabilizers.

SELECTION OF WEATHERABLE COATINGS FOR THERMOPLASTIC OLEFINS—R.A. Ryntz

Journal of Coatings Technology, 63, No. 799, 63 (Aug. 1991)

Consumption of automotive plastics in the United States continues to climb and is expected to double by 1999. It is estimated that the average weight of plastic use per automobile will be 300 pounds. This increased use of plastics, both in interior and exterior applications, also increases the importance of developing coatings for plastics.

This paper will disclose the types of coatings used in plastics. In particular, the surface treatments utilized and types of coatings applied to obtain weatherable, adhesive coatings to thermoplastic olefins will be discussed.

INFLUENCE OF COALESCING AIDS IN ASSOCIATIVE THICKENER DISPERSIONS—K. Alahapperuma and J.E. Glass

Journal of Coatings Technology, 63, No. 799, 69 (Aug. 1991)

The transition in waterborne latex thickeners from nonassociative to associative types has highlighted many formulation sensitivities. The type and concentration of formulation surfactant, the particle size, size distribution, and stabilizing moieties on the latex and structure of the associative thickener have a pronounced effect on the application rheology and applied film properties of the coating. An understanding of these sensitivities in terms of the role of the coalescing aid is undertaken in this paper, using both commercial and experimental materials. The factors noted to be of primary importance are the surface topography and stabilizing moiety of the latex and the molar volume and hydrogen-bonding solubility parameter of the coalescing aid. These variables and their interactions in the complexities of fully formulated coatings are discussed.

Abstracts of Papers in This Issue (continued)

CALCULATION OF BOILING POINTS FROM THE NUMBER OF HOMOLOG CARBONS—C.H. Fisher

Journal of Coatings Technology, 63, No. 799, 79 (Aug. 1991)

The linearity of $(T_b,K)^{1/2}$, where T_b is the boiling point, with the logarithms of chain length (represented by the number of carbons, N_c, or by molecular weight, M), was used to develop simple equations correlating $(T_b,K)^{1/2}$ with $(N_c + k)$ or M for more than 100 homologous series. Boiling points defined by the equations are presumed to be correct, whereas those in substantial disagreement are considered wrong. The equations can be used to estimate many new boiling points by interpolation or by prudent extrapolation. Simple equations are given that correlate n-alkane boiling points with critical temperatures, freezing points, surface tensions, densities, refractivities, and heats of vaporization.

Resumenes de Artículos en este Número

EL BRILLO, LA PELICULA DE PINTURA Y EL MECANISMO DE ENVOLVIMIENTO DEL PIGMENTO—J.H. Braun

Journal of Coatings Technology, 63, No. 799, 43 (Aug. 1991)

La óptica, la percepción del brillo y el fenómeno de brillo relacionado se discuten en términos de intensidad de imagen reflejada y de definición de imagen. Una hipótesis es propuesta para el mecanismo por el cual el pigmento degrada el brillo de la película de pintura.

Las películas de pintura secan en dos situaciones, separadas por un concepto que llamamos punto crítico de superfie. Durante la primera, la más húmeda en el secado, la tensión superficial domina y fuerza a la superficie de película húmeda a permanecer suave a nivel molecular. Conforme la película se seca, la estructura se va desarrollando. Durante la segunda, la más seca, las fuerzas de compresión estructurales dentro de el proceso de secado de pelicula producen "stress", exediendo la tensión superficial y, como la película encoge, la superficie desarrolla microrugocidades que disminuyen el brillo. La estructura dentro de la película es ampliamente controlada, pero no exclusivamente, por la floculacion y la envoltura de las partículas del pigmento.

El mecanismo propuesto es soportado por la ciencia de la pintura y resultados experimentales en óptica, reología, ciencia coloidal, pintura práctica y tecnología de pigmentos.

ESTUDIOS ANALITICOS DE ESTABILIZADORES DE LUZ EN ACABADOS AUTOMOTRICES BICAPA—H. Böhnke, L. Avar, and E. Hess

Journal of Coatings Technology, 63, No. 799, 53 (Aug. 1991)

Los estabilizadores de luz son conocidos por la protecciòn que dan a los acabados automotivos, contra los efectos daninos del medio ambiente. Estos sistemas son estabilizados con absorbedores de la radiación UV en combinación con barredores del tipo HALS. Sin embargo el estabilizador de luz contenido en un esmalte se reduce durante la exposición al ambiente, provocando efectos negativos en dicho estabilizador de luz.

Usando la técnica de sección de microtomo, los acabados automotivos, se quitaron completamente, capa port capa, en secciones de 2μm, mismas que después se analizaron, para saber su contenido de absorbedor UV. De este modo se perfiló el contenido exacto de absorbedor UV que podría ser establecido enrecubrimiento completo lo que permitió tener conclusiones importantes, tales como el comportamiento de los absorvadores de UV durante el secado al horno y a la intemperie. Esos estudios analíticos, fueron hechos para diferentes clases de absorbedores UV, y para varios tipos de acabados bicapa automotivos. Examenes análogos, fueron también evaluados para estabilizadores HALS.

SELECCION DE RECUBRIMIENTOS RESISTENTES A LA INTEMPERIE PARA OLEFINAS TERMOPLASTICAS—R.A. Ryntz

Journal of Coatings Technology, 63, No. 799, 63 (Aug. 1991)

El consumo de plásticos automotivos en Estados Unidos de América, continua creciendo y se espera que se duplique para-1999. Se ha estimado que el peso promedio de plástico utilizado por automóvil será de 300 libras. Este incremento del uso de plastico, tanto para aplicaciones interiores y exteriores, incrementa tambien la importancia del desarrollo de recubrimientos para plásticos.

Este artículo revelará los tipos de recubrimientos usados en los plásticos. En partícular se discutirá el tratamiento de superficie utilizado y tipos de recubrimientos aplicados para obtener recubrimientos resistentes a la interperie y con adherencia adecuada para olefinas termoplásticas.

INFLUENCIA DE AYUDAS FUSIONANTES EN LA DISPERSION ASOCIATIVA DE ESPESANTE—K. Alahapperuma and J.E. Glass

Journal of Coatings Technology, 63, No. 799, 69 (Aug. 1991)

La transición en espesantes de latex para sistemas base agua desde tipos monoassociativos hasta asociativos, ha creado gran sensibilidad en muchas formulaciones. El tipo y concentración de agente tersoactivo en la formulación el tamaño de partícula, el tamaño de distribución y estabilizacion de cada parte en el latex y en la estructura del espesante asociativo tienen un efecto pronunciado en la reología de aplicación y propiedades de película aplicada del recubrimiento. Se intenta dar un entendimiento de esas sensibilidades en términos del papel de la ayuda fusionante en este artículo, utiliazando materias comerciales y experimentales. Los factores que son de primera importancia son la topografía del latex la distribución

Spanish translation of abstracts was provided by Mexico Society Member, Ing. Gustavo Sanchez, Technical Chief, Instituto Mexicano de Técnicos en Pinturas y Tintas, Mexico

de cada parte del volumen molar así como del parametro de solubilidad del puente de hidrógeno de la ayuda fusionante. Esas variables se discuten y sus interacciones en los complejos de formulación completa de recubrimientos.

CALCULO DE PUNTOS DE EBULLICION, A PARTIR DEL NUMERO DE CARBONOS HOMOLOGOS—C.H. Fisher

Journal of Coatings Technology, 63, No. 799, 79 (Aug. 1991)

La linearidad de $(T_b,K)^{1/2}$, donde T_e es°la temperatura de ebullicíon y los logaritmos de longitud en cadena (representada por el numero de carbonos: N_c, o por el peso molecurar, M) fueron utilizados para desarrollar ecuaciones simples, correlacionado $(T_b,K)^{1/2}$ y (N_c+k) ó M por mas de 100 series homólogas. Los puntos de ebullición definidos por las ecuaciones, se supone son correctos, por el contrario aquellos en desacuerdo sustancial, estan considerados como erroneos. Las ecuaciones pueden ser usadas para estimar muchos nuevos puntos de ebullición, por interpolación o por extrapolación moderada. Las ecuaciones simples que se dan correlacionan puntos de ebullición de n-alcano con temperaturas criticas, puntos de congelamiento, tensiones superficiales, densidades, refractividades, y calores de vaporización.

Papers Appearing in the September
JOURNAL OF COATINGS TECHNOLOGY

"Study of Thixotropic Flow Behavior Alkyd Solutions"—A. Kastánek and K. Hájek, of Research Institute for Synthetic Resins and Lacquers, Pardubice, Czechoslovakia

"The Use of Methylated Abietic Acid and Toluene Diisocyanate in the Modification of Triglyceride Oils"—A.T. Erciyes, O.S. Kabasakal, and F.S. Erkal, of Istanbul Technical University, Maslak-Istanbul, Turkey

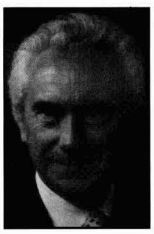
"New Horizons in Coatings Technology"—Raymond B. Seymour, of University of Southern Mississippi, Hattiesburg, MS

"Effects of Acidic Deposition on Painted Wood: A Review"—R. Sam Williams, of Forest Products Laboratory, Madison, WI

Colin D. Penny, of Baltimore, and John A. Lanning, of Louisville, Are Nominated to Federation Officer Positions for 1991-92

Colin D. Penny, President, Hampton Paint Mfg. Company, Inc., Hampton, VA, has been nominated for the position of President-Elect of the Federation of Societies for Coatings Technology.

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



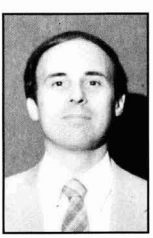
C.D. Penny

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

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

SECRETARY-TREASURER

Nominated to serve as Secretary-Treasurer of the Federation is John A. Lanning, Product Quality Manager, Porter Paints, a Division of Courtaulds Coatings Inc., Louisville, KY.



J.A. Lanning

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

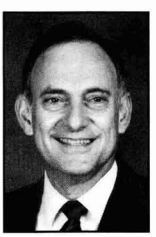
Mr. Lanning is a Past-President of the Louisville Society (1983-84) and received the Society's Outstanding Service Award in 1990. In addition, he was a member of the Membership and Technical Committees.

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

PRESIDENT

The current President-Elect, William F. Holmes, Vice President—Technology, National Pigments & Chemicals, Inc., Garland, TX, will assume the Presidency at the close of the 1991 Annual Meeting, November 6, in Toronto, Ont., Canada.

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



W.F. Holmes

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

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

OTHER NOMINATIONS

The Federation Nominating Committee also submitted the names of candidates for Executive Committee and Board of Directors positions.

Executive Committee

Society Representative Member:

Joseph D. Giusto, Vice President—Operations, Lenmar, Inc., Baltimore, MD, has been nominated for a three-year term. Mr. Giusto is a member of the Executive Committee and has been the Baltimore Society Representative to the Board of Directors since 1985.

J.D. Giusto

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

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

Board of Directors

Past-President Member—(Two-year term):

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

J.E. Geiger

vestment, and Professional Development Committees; and as a Trustee of the Coatings Industry Education Fund.

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

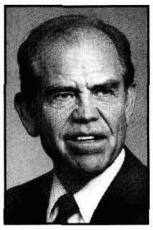
Mr. Geiger was graduated from Northern Illinois University and is a member of the University of Southern Mississippi Industrial Advisory Committee. He has been a member of the coatings industry for 33 years.

Members-at-Large (Two-year terms):

Orville E. Brown, Technical Director, Porter International, a Division of Courtaulds Coatings Inc., Louisville, KY, has been nominated for a two-year term. Mr. Brown is a member of the Corrosion Committee, and served as Chairman of the FSCT's 1991 Spring Seminar Program.

He is a Past-President of the Philadelphia Society (1989-90), and was Chairman of the Society's Investment Committee. Also,

O.E. Brown



J.D. Mullen

Mr. Brown has served as Secretary of the Chicago Society (1982-83). In addition, he is a member of the American Chemical Society, ASTM, and the Steel Structures Painting Council.

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

J. "Dick" Mullen, President, G-3 Industries, Aurora, CO, has been nominated to serve a two-year term. Mr. Mullen is a member of the Environmental Affairs Committee and has served on the Educational Committee. He was the Rocky Mountain Society Representative to the Board of Directors from 1976-80.

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

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

Elections will take place during the Board of Directors meeting on November 3, in Toronto, Ont., Canada.

A Five Kilometer Fitness Run

Especially for Attendees at the 1991 Paint Show in Toronto, Ont., Canada

Tuesday, November 5, 1991, at 7:00 a.m.

Start: East end of Coronation Park—Out and back along a paved foot path

Bus transportation will be available to runners beginning at 6:15 and 6:30 a.m. from two convenient locations, Sheraton Centre and Royal York co-headquarters hotels.

The Paint Show 5000

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In conjunction with the Federation of Societies for Coatings Technology

All runners are invited to join us this year for the annual event on the Paint Show schedule—the Paint Show 5000, a five kilometer fun and fitness run in Toronto, Ontario, Canada.

The run is scheduled to start 7:00 a.m. on Tuesday. Participants will run on a measured, police-protected five kilometer (3.1 mile) course on the beautiful Toronto Shoreline. A time clock will be located at the finish.

The Paint Show 5000 is designed to be a fun, fitness, or training event open to all who want to take a five kilometer running tour of Toronto. Everyone will be a winner!

T-shirts and a sports mini-flashlight will be given to all participants, but you must be pre-registered to run. *No entries will be accepted on race day.*

Entry fee: $5.00 US Funds. **Entries must be received before October 30, 1991.** A portion of every runners' registration fee will be donated to the Coatings Industry Education Fund.

Mail entry form with a check for $5.00 entry fee in US Funds (no cash, please) payable to:

Troy Corporation/Paint Show 5000
One Avenue L, Newark, NJ 07105.

NAME

TITLE

COMPANY

CITY/STATE/ZIP

TELEPHONE

SHIRT SIZE (Circle One)
Large — Extra-Large

In consideration of this entry being accepted, I the undersigned intending to be legally bound, hereby for myself, my heirs, executors and administrators, waive and release any and all rights and claims I may have against the Troy Chemical Corporation, the Federation of Societies for Coatings Technology, the city sponsors, their staff, officials, volunteers and any representatives, *successors or assignees for any injuries that may be suffered by me* in this event. I further hereby certify that I am physically fit and have sufficiently trained for the completion of this event.

NAME (PLEASE PRINT)

DATE

SIGNATURE

FSCT Annual Luncheon Address To Be Given by Michael Broome; Additional Highlights of 1991 Annual Meeting & Paint Show

The Annual Luncheon of the Federation will be held in the Metro Toronto Convention Centre on November 6. Highlighting the event will be an address by Michael Broome, a humorous motivational speaker.

During the past ten years, Mr. Broome has addressed over 2,000 audiences throughout the nation. He is able to adapt his humorous and motivational presentations to virtually any type of audience. While

Michael Broome

addressing the topics of goal setting, people management, stress avoidance, and the family, Mr. Broome emphasizes that achieving a balance in living is the ultimate barometer of success.

As an author and producer of motivational films and cassettes, Mr. Broome's influence extends far beyond the podium. While rising to the top in the speaking profession, he has built a successful marketing business. Mr. Broome is also the founder of the Broyhill Leadership Camps where over 1,500 young adults from across the country learn the principles of success.

Mr. Broome points out that citizens are aware that their countries face serious problems. Each day headlines and newscasts announce the dangers that threaten our economic, political, and family life. We see around us a crisis of confidence. Productivity drops, deficits rise, escapism is rampant, and pessimism becomes more prevalent.

The speaker offers an antidote to this dilemma. As the topics of his talks suggest, Mr. Broome is no Pollyanna. Instead of dwelling obsessively on problems, he goes beyond them to offer a realistic countervision blending hope and confidence, loaded with humor. He teaches his audience to have faith not only in our system, but in their ability to make that system work for them. If Mr. Broome's talks begin with that rare commodity—laughter—they end even more unconventionally in grateful applause and real inspiration.

Tickets for the Annual Luncheon may be purchased from the Federation in advance of the Annual Meeting and Paint Industries' Show or on-site at the Registration area of the Convention Centre.

* * * *

Paint Industries' Show

To be held in conjunction with the 69th Annual Meeting, the 56th Paint Industries' Show will feature the products and services of the suppliers to the international coatings industry. Currently, 264 companies have reserved over 82,000 net square feet of exhibit space—100% of the booth space available at the Convention Centre.

Exhibit hours will be 10:00 a.m. to 5:30 p.m. on Monday, November 4; 8:00 a.m. to 5:30 p.m. on Tuesday, November 5; and, 8:00 a.m. to 12:00 Noon on Wednesday, November 6.

Hotels and Reservations

Nine hotels have reserved blocks of rooms for the Federation event. The Sheraton Centre and Royal York Hotels will serve as co-headquarters for the Annual Meeting and Paint Show. Other hotels include Bond Place, Holiday Inn-Downtown, Hilton International Toronto, King Edward, L'Hotel, Marriott Eaton Centre, and the Westin Harbour Castle. All housing will be processed through the Toronto Convention and Visitors Association. Housing information was sent to all members in April.

Special Airline Fares

American Airlines and Air Canada, in cooperation with the Federation are offering special discount airline fares which afford passengers a 25-40% savings off their round trip and undiscounted day coach fares for travel to the FSCT Annual Meeting and Paint Industries' Show on the airlines' transborder system.

To take advantage of these discounts, you must purchase tickets at least seven days in advance and travel between October 28 and November 12, 1991. For American Airlines, telephone 1-800-433-1790 and ask for STAR File #S-02O1CN; for Air Canada, telephone 1-800-361-7585 and ask for File #917086. The special fares are available only through these numbers.

Discounts are good for both direct and connecting flights to Toronto. If you use a travel agent, have your reservations placed using the toll-free numbers to obtain the same fare advantages. Both American and Air Canada have a variety of other promotional fares, some of which may represent even greater savings. When phoning for reservations, ask for the best discount applicable to your itinerary.

Registration Fees

Advance fees are $65 for members and $80 for non-members. The fee for spouses' activities is $50 in advance. Retired members and their spouses may register for the special advance only fee of $25 each.

The cut-off date for advance registrations is October 4. On-site registration will be $75 for full-time and $55 for one-day for members. Non-members fees will be $95 for full-time and $70 for one-day. Spouses' activities will be $60 on-site.

Host Committee

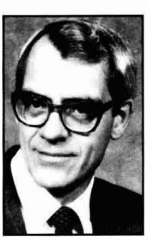
The Toronto Society will serve as the Host for the Annual Meeting. General Chairman of the 1990 Annual Meeting is Larry Ham, of Stochem, Inc. Assisting him are the following sub-committee chairpersons; Information Services—Sandy Palleschi, of Serif Coatings; Program Operations—Scott Harvey, of Chemroy Chemicals; Registration Area—Gordon Major, of Bethco Consultants; FSCT Exhibit—Arthur Hagopian, of Bapco Inc.; FSCT Suite—Caroline Bricknell, of DuPont Canada; and Spouses' Program—Marion Gauley, of L.V. Lomas.

1991 FSCT Mattiello Memorial Lecture

Dr. Loren Hill, Senior Fellow, Monsanto Company

"Structure/Property Relationships of Thermoset Coatings"

Federation's Annual Meeting
Wednesday, November 6, 1991
Toronto Convention Centre
Toronto, Ont., Canada



Dr. Loren Hill

Federation of Societies for Coatings Technology

1991 Annual Meeting and Paint Industries' Show

Housing Information/Application Advance Registration Form

Metro Toronto Convention Centre
Monday, Tuesday, Wednesday • November 4 - 5 - 6
Toronto, Ontario, Canada

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1991 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
METRO TORONTO CONVENTION CENTRE
MONDAY, TUESDAY, AND WEDNESDAY, NOVEMBER 4, 5, 6, 1991

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

The theme of the 1991 Annual Meeting underscores that today's coatings environment requires pro-active marketing and technology strategies. An opportunity today will be a challenge tomorrow if not addressed in a timely and effective manner. To address this theme, programming will emphasize the international perspective and will focus on such topics as quality improvement, cutting edge technology, and environmentally and performance engineered products. Also on the program will be the Mattiello Memorial Lecture, Roon Award Papers, Society Papers, and Seminars. Speakers will come from throughout the world of coatings science and manufacture.

The Paint Industries' Show — the largest and best international exhibit of its kind in the world — will feature attractive exhibitor displays devoted to a wide variety of raw materials, production equipment, containers, laboratory apparatus, testing devices, and services furnished to the coatings manufacturing industry.

The purpose of the Show is to provide attendees with an opportunity to learn of the latest developments in these products and services. Key personnel from the top technical and sales staffs of exhibitors will be on hand. More than 230 exhibitors from the U.S., Canada, and Europe will utilize over 82,000 net square feet of exhibit space at the Show.

Exhibit hours will be:

10:00-5:30 ..... Monday, Nov. 4
8:00-5:30 ..... Tuesday, Nov. 5
8:00-Noon ..... Wednesday, Nov. 6

The Paint Show will be held at the Metro Toronto Convention Centre, and exhibitors who have reserved space in the Show are listed on page 11 in this brochure.

American Airlines and Air Canada, in cooperation with the FSCT, are offering special discounted fares which afford passengers a 25-40% minimum savings off their round trip, undiscounted day coach fares for travel to the FSCT Annual Meeting and Paint Industries' Show on the airlines' domestic systems.

To take advantage of these discounts, you must:

(1) Travel between October 28-November 12, 1991;

(2) Purchase tickets at least seven days in advance;

(3) Phone 1-800-433-1790 (for American Airlines) or 1-800-361-7585 (for Air Canada) for reservations. Immediately reference the FSCT file number: **Star File #S-02O1CN** (for American Airlines) or **File #917086** (for Air Canada). The special fares are available only through these numbers.

Discounts are good for both direct and connecting flights to Toronto. If you use a travel agent, have your reservations placed through the toll-free number to obtain the same fare advantages. Both American Airlines and Air Canada have a variety of other promotional fares, some of which may represent even greater savings. When you phone for reservations, ask for the best discount applicable to your itinerary.

The Board of Directors of the Federation will meet on Sunday, November 3, at 9:00 a.m. in the Sheraton Centre Hotel.

The annual Federation Luncheon will be held on Wednesday, November 6, at the Metro Toronto Convention Centre.

SHERATON CENTRE (Co-headquarters)

Toronto's largest convention hotel located downtown opposite City Hall. The two-acre property contains four restaurants and two lounges as well as indoor/outdoor pool. Non-smoking rooms and facilities for the disabled available. 416-361-1000

ROYAL YORK (Co-headquarters)

Large convention hotel connected to the city's underground shopping network. Six dining spots and non-smoking rooms available. Gym/health club on premises. 416-368-2511

WESTIN HARBOUR CASTLE

Nestled on the shores of Lake Ontario, the hotel offers a resort setting. Three restaurants and two lounges are on the premises. Non-smoking rooms and rooms for handicapped available. 416-869-1600

MARRIOTT EATON CENTRE

Newest hotel in Toronto, next to Eaton Centre, offers two restaurants, two lounges, and complete health club with indoor pool. 416-597-9200

HILTON INTERNATIONAL

Downtown hotel connected to miles of underground shopping malls and restaurants. Indoor pool and health club plus two restaurants and two lounges. 416-869-3187

HOLIDAY INN DOWNTOWN CITY HALL

Adjacent to City Hall, this downtown hotel has three dining spots. Non-smoking floors and full fitness facility on premises. 416-977-0707

BOND PLACE

Situated in the heart of downtown. Non-smoking floors available. Wheelchair access and ample parking. Features cafe and lounge. 416-362-6061

KING EDWARD

Located in heart of the financial district, this historic landmark hotel features world-class elegance. Contains health spa, two restaurants and piano bar. 416-863-9700

L'HOTEL

Connected to Convention Center. Features health club with pool, three restaurants, and a lounge. 416-597-1400

Spouses activities will begin on Monday with an afternoon social in the Metro Toronto Convention Centre. On Tuesday, following a continental breakfast, registered spouses will take a guided tour of the city in a deluxe air-conditioned motorcoach. Included will be such famous landmarks as the prize-winning City Hall, Osgoode Hall, the spectacular Eaton Centre, quaint old St. Lawrence Market, Harbourfront and Queen's Quay, the SkyDome, the gracious University of Toronto Campus, and Casa Loma, Canada's only castle.

An elegant three-course luncheon will be served at famous Ed's Warehouse. After lunch, the tour will continue to the magnificent Royal Ontario Museum. The Museum offers visitors a unique combination of earth and life sciences, fine art and archaeology. The internationally acclaimed collections include Egyptian mummies, Chinese artifacts, and Ming Tomb and even twelve complete dinosaur skeletons. Following the tour of the museum the spouses may either shop in the chic boutiques of Hazelton Lanes or return by motorcoach to the hotel.

Wednesday morning will be a free morning for spouses to continue their exploration of Toronto on their own. The Federation luncheon will be held in the Convention Centre at noon. Tickets will be available at the registration area.

Metro Toronto Convention & Visitors Assn.

Casa Loma, a 98-room "dream castle"— one of the many attractions to be enjoyed in cosmopolitan Toronto

Map Key	Hotel	Singles	Doubles/Twins	Suites 1 BR	Suites 2 BR
1	Sheraton Centre	$140	$155	$300-412	$360-700
	Towers	152	183		
2	Royal York	140	155	425-875	565-1,425
3	Westin Harbour Castle	140	160	250	375
4	Marriott Eaton Centre	139	149		
5	Hilton International	140	155	324	446-900
6	Holiday Inn Downtown City Hall	99	109	175	400
7	Bond Place	89	89		
8	King Edward	165	165	360-485	525-650
9	L'Hotel	145	160	295-400	375-490

*The rates are quoted in Canadian funds. At the present time the U.S. dollar is worth $1.13 Canadian. (To determine the rates in U.S. dollars multiply by .87). The rates are subject to Provincial and Goods and Services Tax and other applicable taxes.

Shuttle bus service will be provided between the cooperating hotels and the Metro Toronto Convention Centre beginning Sunday, November 3

APPLICATION FOR HOTEL ACCOMMODATIONS

Mail to:	**FSCT Housing Bureau** **P.O. Box 126** **207 Queen's Quay West** **Toronto, Ont., M5J 1A7** **Canada** **Fax: 416-367-9088**
By 10/4/91	

Please indicate below the type of accommodations desired and choice of hotels. (Refer to hotel map and rates on opposite page). All reservations will be processed by the FSCT Housing Bureau. Hotel assignments will be made in accordance with prevailing availability. You will receive an acknowledgment from the Housing Bureau. This is not the hotel confirmation. That will come directly to you from the hotel to which you have been assigned. Prior to October 4, all changes must be made, in writing, through the Housing Bureau. After October 4, all modifications should be made directly with the hotel.

A one-nights' deposit MUST accompany each housing request. Checks or credit cards may be used. Checks **must** be made out to FSCT Housing Bureau.

Single (1 person, 1 bed)	_____	_____	(1) _____
Twin (2 people, 2 beds)	_____	_____	(2) _____
Double (2 people, 1 bed)	_____	_____	(3) _____
Suite (parlor and 1 bedroom)	_____	_____	(4) _____
Suite (parlor and 2 bedrooms)	_____	_____	

Type of Room	**Name**	**Dates Arrive**	**Depart**

Please Type Additional Reservations on a Separate Sheet and Attach to This Form

Name _____ Telephone _____

Company _____ FAX _____

Address _____

City, State, Zip _____

Country _____

Name of Credit Card _____ Signature _____

Credit Card Number _____ Exp. Date _____

Note: Requests for accommodations at either the Sheraton Centre or the Royal York will be limited to 10 rooms per company. A parlor counts as one room.

HOW TO MAKE YOUR ARRANGEMENTS

1. To place AIRLINE reservations, call the toll free numbers for American Airlines and Air Canada.

2. To make HOTEL reservations, mail or fax the housing application to the FSCT Housing Bureau. Housing cut-off date is October 4.

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 NOVEMBER 4-6 on your calendar. Don't forget—you get a discount if you register by October 4.

(1) Reservations must be made by October 4, 1991. Reservations may be mailed or faxed. Phone calls will NOT be accepted.

(2) Acknowledgments will be mailed. Please allow 30 days for receipt of acknowledgment. Hotel confirmations will follow the Housing Bureau acknowledgment.

(3) A one-night's deposit **must** accompany each housing 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 October 4, all changes must be made through the Housing Bureau. Changes should be made in letter form. Phone calls will be not accepted. After October 4, all changes should be made directly with hotel.

Advance register to attend the 1991 Annual Meeting and Paint Industries' Show by filling out the form included in this brochure.

The registration options are listed below. Advance registration forms must be received by October 4.

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 in the Convention Centre during the following hours:

Saturday, Nov. 2 ..... 1:00 pm - 5:00 pm
Sunday, Nov. 3 ..... 8:00 am - 7:00 pm
Monday-Tuesday, Nov. 4-5 ..... 7:30 am - 5:30 pm
Wednesday, Nov. 6 ..... 7:30 am - 12:00 noon

On-Site Registration

Register at Convention Centre.

Sunday, Nov. 3 ..... 8:00 am - 7:00 pm
Monday-Tuesday, Nov. 4-5 ..... 7:30 am - 5:30 pm
Wednesday, Nov. 6 ..... 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 4 will be subject to a $10 handling charge. *No refunds will be issued after that date.*

(from Pearson International Airport)

Airport Express Bus (every 20 minutes to downtown hotels) $10.00
Limousine ..... $32-$34.00
Taxi $29.00

(Quoted in Canadian dollars, plus 7% Goods and Services Tax.)

When you arrive at Lester B. Pearson International Airport, you are required to go through Customs & Immigration before collecting your baggage. (You will receive a Customs Declaration form onboard your inbound flight.)

Citizens and legal residents of the United States do not need visas to enter Canada. However, all American citizens must show proof of citizenship. Documents such as a birth certificate, passport, or "green card" are acceptable. You should also carry photo I.D. due to tightened security on all airlines. Naturalized citizens need naturalization certificates or other proof of citizenship. NOTE: A VALID DRIVER'S LICENSE IS NOT SUFFICIENT IDENTIFICATION.

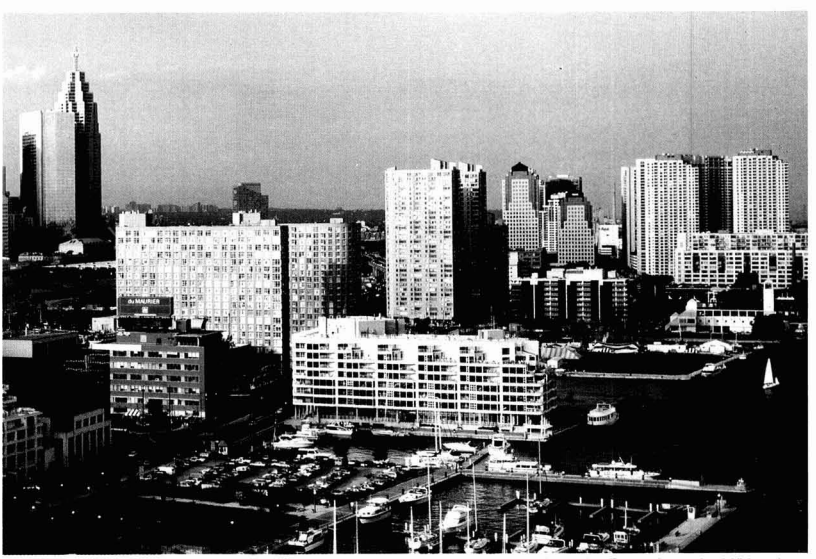
Following immigration, proceed to the baggage claim area to collect your bags. Baggage carts (complimentary) and skycaps are on hand for luggage transfer. Due to tightened security no one other than inbound passengers and ground crew are allowed in the baggage claim area. You are then required to go through customs control.

Citizens of countries other than the United States should check with the Canadian Embassy or nearest Consulate before departure.

We suggest you allow a minimum of 2 to 2 1/2 hours before flight departures to check in to the airport. Upon arrival at Pearson International Airport, you are required to go through U.S. Customs and security with your bags.

For every 30 days, returning U.S. citizens are allowed to bring back duty free, $400 worth of personal or household merchandise, provided they have been out of the U.S. for 48 hours. This amount can include one carton of cigarettes, 100 cigars (no Cuban), one pound of smoking tobacco and 32 ounces of liquor. Goods bought in Canada but manufactured in the U.S. are duty free and not included in the basic exemption; however, a receipt of purchase may be required.

Provincial Sales Tax of 8% and Federal Goods and Services Tax of 7% are levied on goods and services purchased for use of consumption within Ontario. In general, visitors may apply for a refund of these taxes once they have accumulated $100 worth of receipts for non-disposable merchandise to be used outside Canada. Sales Tax refund forms can be obtained on arrival in Toronto at the Transport Canada Information Desk or Canada Customs Office.



Metropolitan Toronto Convention & Visitors Assn.

Downtown Toronto and Harbourfront—Toronto's harbourfront features year-round recreational facilities, and is close to the SkyDome stadium and the CN Tower

1991 PAINT INDUSTRIES' SHOW

Current List of Exhibitors

ACS-Datacolor
ALT-Chem International
Aceto Corp.
Advanced Coating Technologies
Advanced Software Designs
Air Products & Chemicals, Inc.
Ajinomoto U.S.A., Inc.
Akzo Chemicals Inc.
Alcan-Toyo America, Inc.
Alcoa Industrial Chemicals
Allied Signal, Inc.
Ambrose Co.
American Cyanamid Co.
American Iron and Steel Institute
Amoco Chemical Co.
Ampac, Inc.
Anachemia Solvents Ltd.
ANGUS Chemical Co.
Anker Labelers USA, Inc.
Aqualon Co.
Arco Chemical Co.
Aries Software Corp.
Ashland Chemical Co., Coatings & Resins Division, Canada
Atlas Electric Devices Co.
Atochem North America
Automated Filling Specialists Corp.

B.A.G. Corp.
BASF Corp., Chemicals Division
B&P Environmental Resources
Blackmer Pump Division, Dover Resources Co.
Bohlin Reologi, 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 Division
Calgon Corp., Division of Merck & Co., Inc.
Canada Colors & Chemicals Ltd.
The Carborundum Co.
Cardolite Corp.
Cargill, Inc.
Carroll Scientific, Inc.
Catalyst Resources, Inc.
Celite Corp.
Cellier Corp.
Chemical & Engineering News
Chemical Marketing Reporter
Chemical Week
Coatings Magazine
Color Corp. of America
Colorgen, Inc.
Columbian Chemicals Co.
Consolidated Research, Inc.
Cookson Pigments Inc.
Coulter Electronics, Inc.
Cray Valley Products International
Crosfield Chemicals, Inc.
Cuno Process Filtration Products
Cyprus Industrial Minerals Co.

D/L Laboratories
DSA Consulting, Inc.
DSET Laboratories, Inc.
Daniel Products Co.
Davies Can Co.
Day-Glo Color Corp.
DeFelsko Corp.
Degussa Corp.
University of Detroit
Disti, Inc./Distill-Kleen Inc.
Dominion Colour Corp.
Dow Chemical USA
Dow Corning Corp.
Draiswerke, Inc.
Drew Industrial Division
Dry Branch Kaolin Co.
Du Pont Co.

E.C.C. America
EM Industries, Pigments Division
Eagle Picher Minerals, Inc.
Eagle Zinc Co.
Eastern Michigan University
Eastman Chemical Products, Inc.
Ebonex Corp.
Eiger Machinery, Inc.
Elcometer, Inc.
Elektro-Physik USA, Inc.
Elmar Industries, Inc.
Engelhard Corp., Spec. Min. & Colors Group
Entex Plast Consulting
Epworth Manufacturing Co., Inc.
Etna Products Inc., Specialty Chemical Division
Exxon Chemical Co.

FCF-Bowers, Inc.
FMC Corp., Food & Pharmaceutical Division
FMJ International Publications
Fawcett Co., Inc.
Federation of Societies for Coatings Technology
Filter Specialists, Inc.
Fischer Technology, Inc.
Freeman Polymers Division/Cook Composites & Polymers

GAF Chemicals Corp.
GAF Filtration Products
Paul N. Gardner Co., Inc.
Geneq, Inc.
B.F. Goodrich Co., Specialty Polymer & Chemical Division
W.R. Grace, Davidson Chemical Division
Guer-Tin Brothers Polymers

H.E.R.O. Industries Ltd.
Halox Pigments, Division of Hammond Lead Products
Harcros Pigments, Inc.
Henkel Corp., Process Chemicals
Hilton-Davis Co.
Hockmeyer Equipment Corp.
Hoechst Celanese Corp.
Hoechst Celanese Corp. Waxes & Lubricants Group
Horiba Instruments, Inc.
J.M. Huber Corp.
Hüls America, Inc.
Hungalu Trading Co.
Hunterlab

ICI Americas, Inc.
ICI Resins U.S.
Ideal Mfg. & Sales Corp.
Industrial Finishing Magazine
Interfibe Corp.
International Compliance Centre
International Resources, Inc.
S.C. Johnson Wax

K-T Feldspar Corp.
Kemira, Inc.
Kenrich Petrochemicals, Inc.
Kent State University
King Industries, Inc.
Klieverik Dispensing Systems, Inc.
Krones Machinery Co., Ltd.
Kronos, Inc.

Labsphere, Inc.
Laporte Absorbents, Inc.
Leeds & Northrup, A Unit of General Signal
Liquid Controls Corp.
The Lubrizol Corp., Coatings Technologies

3M, Industrial Chemicals Division
MTS Colorimetrie
Macbeth Division, Kollmorgen Corp.
Malvern Instruments
Malvern Minerals Co.
Matec Applied Sciences
McWhorter, Inc.
The Mearl Corp.
Michelman, Inc.
Micro Powders, Inc.
Micromeritics Instrument Corp.
Mid-States Eng. & Mfg. Co.
Miller Manufacturing Co., Inc.
Millipore, Inc.
Milton Can Co., Inc.
MiniFibers, Inc.
Minolta Corp.
Mississippi Lime Co.
University of Missouri-Rolla
Mitech Corp.
MixMor, Inc.
Mobay Corp.
Modern Paint & Coatings
Morehouse Industries
Morton International
Mountain Minerals Co., Ltd.
Myers Engineering

NYCO
Nacan Products Ltd.
Netzsch Incorporated
Neupak, Inc.
New Way Packaging Machinery
Nicolet Instrument Corp.
Nippon Shokubai America, Inc.
North Dakota State University

Ohio Polychemical Co.
Ortech International
Otsuka Electronics (U.S.A.) Inc.

PPG Industries, Silica Prods.
P Q Corporation
Pacific Anchor Chemical
Pacific Micro Software Eng.
Paint & Coatings Industry Magazine
Pen Kem, Inc.
Peninsula Polymers
Pfizer Specialty Minerals
Philips Container Co.
Phillips 66 Co., Specialty Chems.
Plastican, Inc.
Polar Minerals
Poly-Resyn, Inc.
Premier Mill Corp.
Progressive Recovery Inc.
Purity Zinc Metals Co. Ltd.
Pyosa S.A. De C.V.

The Q-Panel Co.
Quantachrome Corp.

Raabe Corp.
Radtech International North America
Red Devil, Inc.
Reichhold Chemicals, Inc.
Rheox, Inc.
Rhone-Poulenc Inc.
Rhopoint Instrumentation Ltd.
Rohm and Haas Co.
Rosedale Products, Inc.
Charles Ross and Son Co.
Roto-King, Inc., Unit of Idex Corp.

SCM Chemicals
Sandoz Chemicals Corp.
Sanncor Industries, Inc.
Sartomer Co.
Schenectady Chemicals Canada
Scott-Bader
Semi-Bulk Systems, Inc.
Serac, Inc.
Shamrock Technologies, Inc.
Shell Chemical Co.
Sherwin-Williams Chemicals Co.
Shimadzu Scientific Instrument
Silberline Manufacturing Co.
Sino-American Metals & Minerals
Siva International, Inc.
Smart Turner Ltd.
South Florida Test Service
University of Southern Mississippi
Startex Chemical Co.
Steel Structures Painting Council
Sub-Tropical Testing Service
Sun Chemical Corp.
Systech Environmental Corp.

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

U.S. Borax & Chemical Corp.
U.S. Silica Co.
Unimin Specialty Minerals Inc.
Union Carbide Chemicals & Plastics
Union Process, Inc.
United Catalysts, Inc.
United States Testing Co., Inc.
Unocal Chemicals Division, Unocal Corp.

Van Waters & Rogers
R.T. Vanderbilt Co., Inc.
Velsicol Chemical Corp.
Versa-Matic Tool, Inc.
Vorti-Siv Division, M&M Machine

Wacker Silicones Corp.
Warren-Rupp, Inc.
Whallon Machinery Inc.
Wilden Pump & Engineering Co.
Witco Corp.

X-Rite, Incorporated

York Fluid Controls Ltd.

Zeelan Industries, Inc.

1991 Advance Registration

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

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

Please fill out this form and mail with a check in the correct amount (made payable to the FSCT) **to the Federation address shown above.** All checks must be payable in U.S. Funds. Any that are not will be returned. DEADLINE DATE FOR ADVANCE REGISTRATION IS OCTOBER 4. NONE WILL BE ACCEPTED AFTER THAT DATE.

A $10.00 charge will be made for cancellations received prior to October 4. No refunds will be made after that date.
NO CREDIT CARDS WILL BE ACCEPTED

INDUSTRY REGISTRATION FEES — INFORMATION IS REQUESTED ONLY

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

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 PERSON

D ☐ SPOUSE $50.00

NICKNAME

FIRST NAME LAST NAME

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

SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:

H ☐ $25.00

TICKETS FOR FEDERATION LUNCHEON WEDNESDAY, NOVEMBER 6 ($35.00)

Z ☐ NUMBER REQUIRED: _____ $25.00 EACH.

A CHECK IN THE AMOUNT OF:
$_____
IS ENCLOSED

OSHA and ANSI Sign Working Agreement; ANSI to Accredit Third Party Certifiers

The Occupational Safety and Health Administration (OHSA), of the U.S. Department of Labor, and the American National Standards Institute (ANSI), the coordinator of the U.S. private sector administered voluntary standardization system, have signed a Memorandum of Understanding that formalizes the cooperative working relationship that exists between the two organizations. The Memorandum of Understanding was signed by Gerard F. Scannell, the Assistant Secretary of Labor for OSHA, and Manuel Peralta, ANSI President.

The agreement is intended to enable ANSI and OSHA to provide mutual technical assistance for each organization's standards setting responsibilities. In addition, the two organizations have agreed to consult each other in planning standards in areas of mutual concern.

Among the various provisions set forth under the Memorandum of Understanding, ANSI is committed to continuing to coordinate the development of national consensus standards on occupational safety and health issues and providing draft copies of international standards to OSHA for comment, as ANSI coordinates the overall U.S. position on these standards. OSHA will participate on selected ANSI accredited standards committees and provide ANSI with appropriate research reports it develops.

In other news, ANSI has expanded its program to accredit third party certification programs. Under this expansion, the first certificate of accreditation in the U.S. for a water additives program has been awarded to NSF International.

Accreditation of third party certification is offered by ANSI when full compliance with the requirements of ANSI Z34.1, American National Standard for Certification—Third Party Certification Program, has been demonstrated. Review of policy and quality assurance documents, and facilities visits to the certifier and its clients are included in the conformity assessment process.

NSF International, Ann Arbor, MI, is a third-party certifier of products with public health or environmental quality significance.

NPCA Announces Start Of Annual PIP Campaign

The Picture-It-Painted (PIP) program of the National Paint & Coatings Association, Washington, D.C., began its 11th year in May. The community service campaign is designed to renew and beautify communities nationwide.

Last year, the PIP program produced a total of 50 projects. Among these projects were historic sites, low-income and senior citizen homes, nonprofit-run facilities, graffiti-removal campaigns, and neighborhood paintathons.

Community improvement projects involving paint will take place throughout these summer months. The 1991 PIP season will culminate in September, with the deadline for the annual Allen W. Clark award competition.

CMA Presents Lammot du Pont Safety Awards During Annual Meeting, June 6-8, 1991

The Chemical Manufacturers Association (CMA), White Sulphur Springs, WV, has honored Union Carbide Corporation, Degussa Corporation, and Milliken Chemicals, Division of Milliken and Company, for their outstanding safety records.

The Lammot du Pont Safety Award plaques were presented during CMA's Annual Meeting, held in White Sulphur Springs. This year marks the 40th year that CMA member companies have been recognized for improving safety records under the Lammont du Pont Safety Award program.

The awards are presented to CMA member companies which have shown, in their respective categories, the greatest percentage reduction in total recordable incidence rates of occupational injuries, deaths, and illnesses during the past five years. In addition to the reduction in injury rates, a company's total recordable incidence rates for the award must not exceed the average for all companies in the same category.

The awards are presented to companies working: more than 20 million exposure hours annually; 2 to 20 million exposure hours annually; and less than two million hours annually.

Union Carbide was the winner in the large-size company category, Degussa accepted the mid-size company prize, and Milliken Chemicals accepted the award for smaller companies.

At the meeting, certificates of merit were awarded for the second place winners in each category. The winners were: large company—E.I. du Pont de Nemours and Company; mid-size company—Nalco Chemical Company; and small company—Unocal Chemicals Division, Unocal Corporation.

Construction Contracting Falls 5% in May

Construction contracting for May was down 5% according to a report compiled by F.W. Dodge Division of McGraw-Hill, Inc., New York, NY.

Construction contracting in May drew most of its support from residential building. Modest increases in both single family and multifamily housing starts in May lifted the value of total residential building 3%, after adjustment for seasonality.

May contracting for nonbuilding construction (public works and utilities) fell a seasonally adjusted 15%, after a 20% gain in April. May's back-to-normal rate of contracting was consistent with recent strength in publicly funded construction.

Contracts for nonresidential buildings (commercial, industrial, and institutional) slid 8% in May, with declines in all three subcategories.

At the end of five months, 1991 construction contract value was 16% below its five month total of 1990. With one exception, the shortfall was distributed evenly among regions: Northeast—down 16%; North Central—down 8%; South Atlantic—down 19%; and West—down 19%. The South Central region, however, was down only 3% below 1990's value.

Mergers & Acquisitions...

Sundstrand Corporation Purchases Milton Roy

Sundstrand Corporation, Rockford, IL, has completed the acquisition of Milton Roy Company, Rochester, NY. As a result of the acquisition, Milton Roy will operate as a wholly owned subsidiary of Sundstrand.

According to officials, the merger is expected to bring about very few changes in Milton Roy's operations.

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Inmetal of France to Acquire Dry Branch Kaolin

Asea Brown Boveri Inc. has entered into a sale and purchase agreement with Inmetal, Paris, France, for the acquisition of Dry Branch Kaolin Company, Dry Branch, GA. The proposed sale was subject to approval by U.S. regulatory authorities.

An expansion is underway at the facility to increase production capacity to more than 800,000 tons by October 1991.

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Heraeus and DSET Merge Weathering Activities

DSET Laboratories Inc., Phoenix, AZ, and Heraeus Instruments, Inc., Hanau, Germany, have completed a merger of their weathering activities.

As a result of this merger, Heraeus DSET Laboratories, Inc., will operate outdoor weathering services at Arizona and Florida facilities, as well as laboratory testing in weathering chambers. The new incorporation will manufacture, distribute, and service the Heraeus Xenotest® product line including Xenotest 1200 CPS and Suntest CPS weathering chambers and other weathering equipment.

Heraeus DSET Laboratories, Inc., has named Joe Robbins, former General Manager, to the position of President; Thomas H. Ihlenfeldt, Chairman of the Board; and Klaas Oostlander, Director.

Heraeus acquired 36% of DSET in 1988. As a result of the completed merger, Heraeus has obtained an additional 44% of DSET.

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Perkin-Elmer and Arnel Inc. Form Agreement

The Perkin-Elmer Corporation, Norwalk, CT, and Arnel Inc., Parlin, NJ, have entered into a cooperative agreement to jointly engineer and globally market gas chromatography (GC) products and systems.

The new agreement will focus on developing instrument systems for the petroleum, environmental, research, quality control, and process markets, as well as other new products and GC systems.

Initially, Perkin-Elmer will concentrate on customizing its GC systems with Arnel technology for applications tailored to the petroleum industry. Anticipated petroleum-specific standard products will include: simulated distillation analyzers, natural gas analyzers, refinery gas analyzers, and PNA analyzers.

Du Pont Chemicals and ConAgra Form Venture

Du Pont Chemicals, Wilmington, DE, and ConAgra, Inc., have announced the formation of a joint venture to market polylactides—polymers made from lactic acid. The joint venture has assumed the name Ecological Chemical Products Company (Ecochem).

The new company currently is developing polylactides, and commercial quantities of the new material are projected to be available in late 1994. The polylactide materials are being developed from renewable resources such as cheese whey and corn. Ecochem's proprietary manufacturing technology will convert these resources to high-purity lactic acid, derivatives, and polymers.

Polylactides are being designed to exhibit degradability and to enable the recycling of some paper products in ways not available at the present.

In addition, Ecochem is constructing a $20 million lactic acid manufacturing facility in Adell, WI.

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Grow Group, Inc. Agrees to Sell Certain Assets

Grow Group, Inc., New York, NY, has announced that it has accepted a letter of intent to sell the bleach business and certain assets of its Consumer and Professional Products Group, in Commerce, GA, and Phoenix, AZ, respectively, to All Pure Chemical Company, subsidiary of Pioneer Chlor Alkali Investments, Inc, Houston, TX.

Also, Grow Group has executed a supply agreement and a contract with North America Packaging Corporation for the sale of its plastic injection molding production lines, also located in Commerce.

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PPG and Nippon Steel Form New Company

The Coatings and Resins Group, of PPG Industries Inc., Pittsburgh, PA, and Nippon Steel Chemical Company, Japan, have signed an agreement to form a company in Japan to manufacture and market industrial coatings.

The joint venture, Shinnikka PPG Company, Ltd., will be owned 50% by PPG and 50% by Nippon.

The deal has been approved by the Board of Directors of both companies. Shinnikka will be headquartered in Tokyo, Japan.

Shinnikka will produce coatings for industrial customers in Japan, including coil, can, appliance, and extrusion products.

• • • •

Sico, Inc. Purchases DeSoto Coatings Ltd.

Sico, Inc., Longueuil, Que., Canada, has purchased DeSoto Coatings Ltd., Mississauga, Ont., Canada. With the purchase, DeSoto became a wholly owned subsidiary of Sico.

Effective immediately, DeSoto's new name is Prilco Inc. The change will not affect any other aspects of DeSoto Coatings Ltd.'s business.

ASTM Completes Three New Standards On Power Generation Facilities

ASTM, Philadelphia, PA, has announced the completion on three new standards: "Inspection Requirements in Specifications"; "In Service Coating Evaluation"; and "Holiday Testing of Steel Substitutes." Standards-writing Committee D-33 on Protective Coating and Lining Work for Power Generation Facilities wrote the new standards.

In addition, Committee D-33 is continuing work on other inspection standards, including: "Service Water Systems Maintenance Manual"; "Graded Quality Assurance System"; and "Flue Gas Desulfurization Standard." Also, the committee will be updating the existing decontamination standard, D 4256 "Test Method for Determination of the Decontaminability of Coatings Used in Light-Water Nuclear Power Plants."

The next meeting of Committee D-33 is scheduled for the Holiday Inn, in Cocoa Beach, FL, on October 28-31. Topics to be discussed are: the recently enacted Clean Air Act and its importance on protective coatings; the NUPIC system of uniform quality assurance auditing; and the in-place internal cleaning and lining of service water piping.

For more information, contact Steve Pinney, S.G. Pinney & Associates, 473 S.E. Verada Ave., Port St. Lucie, FL 34983, or Susan Canning, ASTM, 1916 Race St., Philadelphia, PA 19103.

Yukong ARCO Chemical Dedicates New Facility

Yukong ARCO Chemical, Ltd., has built a state-of-the-art propylene oxide and styrene monomer plant at its complex in Ulsan, South Korea. Yukong ARCO is a 50/50 joint venture between ARCO Chemical Korea, Inc., and Yukong Ltd.

The plant has an annual rated capacity of 100,000 metric tons of propylene oxide and 225,000 metric tons of styrene. Also, the facility has the ability to produce 25,000 metric tons of propylene glycol and 18,000 metric tons of polyols, both derivatives of propylene oxide.

Yukong Ltd. is a member of the Sunkyong Group Companies. ARCO Chemical Korea, Inc., is a subsidiary of ARCO Chemical Company, Newtown Square, PA.

Union Camp to Participate In EPA Pollution Project

Union Camp Corporation, Wayne, NJ, has announced that it will participate in the Environmental Protection Agency's (EPA) voluntary Industrial Toxics project, "The 33/50 Plan."

Under the project, companies are asked to voluntarily reduce pollution caused by 17 high priority toxic chemicals.

EPA's goal is to reduce by 33% the total releases and transfers of the 17 target chemicals by 1992, and to reduce them by 50% by 1995.

Plastics Resins Production Increases 4% in March

The production of plastics resins totaled 4.3 billion pounds in March, down 5.8% from March of 1990, according to a report released by The Society of Plastics Industry, Washington, D.C. The final statistics were compiled by the Committee on Resin Statistics.

The production figures for March were up nearly 4% over February's total. The production year-to-date totals were 12.8 billion pounds, a decrease of less than 1% from the same time period in 1990.

According to the Committee's report, sales and captive (internal) use of plastics resins in March exceeded 4.3 billion pounds, a decrease of 8.8% from the same month one year ago. Sales for March increased nearly 9% from February. Sales and captive use year-to-date are running 6.6% below the same time period in 1990.

Women in Coatings Accepting Nominations For Annual Awards Presentation

Women in Coatings is accepting the names of all women for the 1991 Women in Coatings Awards, to be presented during the Federation of Societies for Coatings Technology Annual Meeting, in Toronto, Ont., Canada, on November 4-6, 1991.

The awards are presented to those women who have made a significant contribution in support of paint and coatings and/or related industries. Contributions can include the publication of technical or nontechnical papers, presentations of information, or any important accomplishment which benefits the industry in general.

The Women in Coatings Award categories are as follows:

Communications—Overall contributions such as product information, promotions, advertising, and general public relations.

Management—Overall management of products, projects, customer accounts, department, or staff.

Leadership—Ability to lead within the industry as in actively participating in professional and trade organizations.

Research & Development—Overall contribution by way of research and development such as product innovation and processes.

Sales and Marketing—Overall contribution by way of sales and marketing as evidenced by increased recognition by customers and business associates within the industry, significant increase in sales, and development of a certain market segment.

Purchasing—Overall contribution resulting in cost savings of purchased materials, improvement of product quality by purchasing from quality conscious suppliers, and JIT inventory.

Industry Support—Other branches within the companies that are not included in the preceding categories (e.g., laboratory technicians, secretarial and clerical help, customer service and order desk, shipping and receiving, and computer operators).

The Awards bring recognition to those who have contributed to the advancement of coatings and provide an incentive to those women striving for excellence in their fields.

The group attempts to unite women in coatings and/or related industries in a forum where support can be derived and common experiences can be shared in overall pursuit of creating a stronger, more versatile industry.

Nominations for the Women in Coatings Awards, along with the nominee's name, award category, and accomplishment(s) and appropriate date(s), should be forwarded to Eve De La Vega-Irvine, c/o J.M. Huber Corp., Clay Div., One Huber Rd., Macon, GA 31298.

1990 ANNUAL REPORT

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Spring 1991 Board of Directors Meeting

Thirty-five members and 16 guests attended the Spring Meeting of the Board of Directors of the Federation of Societies for Coatings Technology on May 15, 1991, in Philadelphia, PA.

The following were in attendance:

Officers

President ..... Kurt F. Weitz
President-Elect ..... William F. Holmes
Secretary-Treasurer ..... Colin D. Penny

Society Representatives

Baltimore ..... Joseph D. Giusto
Birmingham ..... Gerry J. Gough
C-D-I-C ..... Lloyd J. Reindl
Chicago ..... Richard M. Hille
Cleveland ..... Fred G. Schwab
Dallas ..... Bruce Alvin
Detroit ..... William W. Passeno
Golden Gate ..... Timothy J. Donlin
Houston ..... James W. Judlin
Kansas City ..... Norman A. Hon
Los Angeles ..... Jan P. Van Zelm
Louisville ..... James A. Hoeck
Mexico ..... Artura Ita
Montreal ..... Horace S. Philipp
New England ..... Maureen M. Lein
New York ..... Richard J. Himics
Northwestern ..... Sarah Oebser
Pacific Northwest ..... William A. Shackelford
Philadelphia ..... Wayne A. Kraus
Piedmont ..... James E. Husted
Pittsburgh ..... Raymond C. Uhlig
Rocky Mountain ..... John Delmonico
Southern ..... Dan Dixon
Toronto ..... Arthur K. Hagopian
Western New York ..... Gerald Ivancie

Other Members

John C. Ballard ..... Louisville
Thad T. Broome ..... Southern
Carlos E. Dorris ..... Dallas
Louis F. Holzknecht ..... Louisville
Berger G. Justen ..... Southern
John A. Lanning ..... Louisville
Deryk R. Pawsey ..... Pacific Northwest

Guests

Federation Past-Presidents Neil S. Estrada, James E. Geiger, Terryl F. Johnson, William Mirick, and John Oates. (Board Members John Ballard, Carlos Dorris, and Deryk Pawsey are also Past-Presidents of the Federation.)

George Pilcher, President, Coatings Industry Education Fund.

Federation Committee Chairmen Donald Boyd (Educational) and Brenda Carr (Membership).

Society Officers who attended the following day's meeting of Incoming Society Officers: James Smith (Baltimore), Tony Wallington (Birmingham), Paul Guevin (C-D-I-C), Martha Colin (Mexico), Bruce Bridges (Montreal), Flora Wong (Pacific Northwest), and Dick Mullen (Rocky Mountain).

Chuck Reitter, President, American Paint Journal Co.

Staff

Michael G. Bell, Director of Educational Services; Rosemary Falvey, Director of Meetings and Conventions; Victoria Graves, Meetings Coordinator; Thomas A. Kocis, Director of Field Ser-

vices; Patricia D. Viola, Director of Publications; and Robert F. Ziegler, Executive Vice President.

The report of the Fall 1990 Board of Directors Meeting was approved as published in the January 1991 JOURNAL OF COATINGS TECHNOLOGY.

Reports of the Officers And Staff

PRESIDENT WEITZ

It is with much pleasure that the Federation Board of Directors is welcomed to the Open House at the new Federation headquarters office building. Under the capable direction of Jim Geiger, the duties of the Ad Hoc Building Committee have been admirably fulfilled.

Plans for the 1991 Paint Show, in Toronto, are going well. I am especially pleased that the Keynote Speaker will be Peter C. Newman, noted Canadian author and senior editor of *MacLean's*, which is Canada's *Newsweek*. In addition, a third terminal has been added to Toronto's International Airport which will greatly assist in a smooth passenger flow for the 1991 Show.

Since the 1990 Washington Paint Show, Federation activities have resulted in visits of the President to Society meetings in Baltimore, Philadelphia, and Mexico City, and to the Southwestern Paint Convention, Southern Society Annual Meeting, West Coast Societies Symposium and Show, and the Pacific Northwest Society Symposium. The President also represented the Federation at the annual meetings of the National Decorating Products Association and the Mexico Association of Paint and Printing Ink Manufacturers. The Federation continues to be held in high esteem due, in part, to the capable direction of the Executive Committee. Sincere thanks are also due to all Committee Chairpersons for their hard work.

The coatings industry continues to undergo tremendous consolidation. If our industry is to emerge competitive and healthy, every ounce of benefit must be wrought from each raw material. With the advent of a free trade block from Mexico to Canada, the days of shipping raw materials all over the continent will diminish, and more emphasis will be placed on the use of local raw materials. There will be a corresponding need for the exchange of information. Closer liaisons with the adhesives, sealants, plastics, and rubber industries would be beneficial and would promote Federation membership.

KURT F. WEITZ,
President

From left: FSCT President-Elect William Holmes (Dallas) and Executive Vice President Robert Ziegler

PRESIDENT-ELECT HOLMES

Duties of the office accelerated at the expected pace after the first of the year. Official functions included visits to the Golden Gate Society on January 14, the Chicago Society on March 4, and the Piedmont Society on March 20. The diversity, dedication, and desire of the local Societies continue to amaze and gratify the visiting Officers and Staff. The video tape from the Annual Meeting and Paint Show is a valuable training tool and public relations vehicle that seems well received by those exposed to it.

Other than Society visits, the January meeting for Finance, Executive, and Investment Committee was held at the new headquarters building—a truly impressive structure. This is an achievement for the Federation. NPCA invited me as a representative of the Federation to attend their board meeting in Tarpon Springs, FL on March 6-7. A report has been made to the Executive Committee. No comments were solicited; however, they did offer complimentary registration to the event. The industry is undergoing some major upheavals, as we all know, due to the takeovers, acquisitions, and consolidations. NPCA is grappling with these problems and continues to look to us for assistance in the technical arena.

Even in a period of economic and organizational uncertainty, the Federation appears to be able to steer a course of assistance and involvement to its Constituent Societies.

WILLIAM F. HOLMES,
President-Elect

SECRETARY-TREASURER PENNY

In my position as Secretary-Treasurer, I have visited the following Societies: Baltimore, Philadelphia, Montreal, and Cleveland. During these visits, we were able to meet with the respective Executive Committees, and at the General Meeting, showed the video of the Opening Session of the 1990 Paint Show. It was received enthusiastically.

In addition, I have met with the following Federation groups: Accounts Review Committee, Professional Development Committee, Coatings Industry Educational Fund, Investment Committee, Finance Committee, and Executive Committee.

COLIN D. PENNY,
Secretary-Treasurer

EXECUTIVE VICE PRESIDENT ZIEGLER

1990 FINANCIAL STATEMENT

The final, audited report of revenue and expense for 1990 showed total revenues of $2,693,193 and expenses of $2,482,955. The statement has been sent to the Board. Of note is the excess of revenue over expenses of $210,238, which is an increase of 27% over 1989.

1991 BUDGET AND FIRST QUARTER STATEMENT

The Finance and Executive Committees have approved the 1991 budget, allocated as follows:

Income: Publications—31%; Membership Dues—1.8%; Annual Meeting and Paint Show—58.2%; Educational Activities—1.9%; and Miscellaneous—7.1%.

Expenses: Federation Office/Administration—37.3%; Publications—27.4%; Annual Meeting and Paint Show—18.1%; Officers/

Board/Committees—7.4%; Educational Activities—6.5%; and Miscellaneous—3.3%.

The 1991 Budget is balanced at $2,654,000.

The first quarter statement shows an increase of revenue over expenses of $1,001,057 (vs. $1,043,723, in 1990, and $802,382, in 1989).

Publications

JCT—Total pages published in 1990 were 1,206 compared to 1,199 in 1989. Advertising continues to slip slightly (down 10 pages from 1989 to 254) despite all marketing efforts. Due to the economic downturn in the industry during the last half of 1990, many advertisers have decreased their marketing budgets causing a slump felt throughout industry publications. However, we are pleased to report that the advertising income budget of $450,000 was met, and exceeded, by $2,748.

Editorially, increases were also seen in both technical articles and Federation-related news pages. The "Guide to Coatings Courses" was published in the February 1991 issue, and the initial publication of the Pacific Northwest Society Newsletter on Safety and Manufacturing was featured in the March issue. We were pleased to be able to feature this newsworthy item and anticipate its publication in several issues during the year.

The Federation's desktop publishing system has come into its own and has been upgraded with the recent move to the new headquarters offices. To date, over $54,000 in savings have been realized by in-house typesetting much of the *JCT*. Additionally, typesetting costs have been drastically reduced for all of the FSCT publications, including the Series Booklets, Annual Meeting Program Book, and Year Book. As a service to Societies, the system was used to typeset the Pittsburgh Society's history booklet.

Year Book—The 1991 Annual Membership Directory was published in March and mailed to all members. We sincerely appreciate the excellent cooperation of those Societies which forwarded their rosters on time.

Series Booklets—The 16th addition to the *Federation Series on Coatings Technology*, "Introduction to Coatings Technology," by Alan Brandau, was published just prior to the 1990 Annual Meeting. Scheduled for publication in 1991 are "Cationic Radiation Curing," by Joseph V. Koleske, and "Rheology," by Clifford Schoff. Approximately 15 additional booklets are in various stages of completion and will join the previously published monographs: "Film Formation"; "Radiation Cured Coatings"; "Introduction to Polymers and Resins"; "Solvents"; "Coil Coatings"; "Corrosion Protection by Coatings"; "Mechanical Properties of Coatings"; "Automotive Coatings"; "Coating Film Defects"; "Application of Paint and Coatings"; "Organic Pigments"; "Inorganic Primer Pigments"; "Marine Coatings"; "Sealants and Caulks"; and "Aerospace and Aircraft Coatings." We sincerely thank the Series Editors Drs. Thomas J. Miranda and Darlene Brezinski for their efforts.

Revised IR Atlas—The new, revised edition of the *Infrared Spectroscopy Atlas for the Coatings Industry* is nearing completion and will be published by mid-year. The 1991 edition features over 2,500 spectra. The spectra have been digitized and will be available as a computer software package by the Nicolet Instrument Corp., which jointly with the FSCT will market both the published volume and the software. In addition, the Federation has contracted with Shuppan Boeki, the largest technical book distributor in Japan, for its exclusive marketing and distribution rights in that country. The agreements with both Nicolet and Shuppan Boeki will significantly increase the worldwide distribution and sale of the *Infrared Atlas*.

Membership

Total membership remains fairly static at 7,392 vs. 7,373 in 1990, and 7,406 in 1989. However, when considering the increasing number of consolidations within the industry it is significant that membership retention continues to be successful. Current membership breakdown is: Active—4,654; Associate—2,198; Educator/Student, Retired, Honorary—540. Society Membership Chairmen are to be congratulated for their efforts. In particular, outstanding increases in membership were seen in the Rocky Mountain (52.6%), Piedmont (31.6%), and Toronto (12%) Societies. Certificates of Appreciation will be presented to these Societies' Representatives at the Board Meeting in Philadelphia.

President Kurt F. Weitz (Toronto) and Secretary-Treasurer Colin Penny (Baltimore)

A membership drive, headed by FSCT Membership Chairman Brenda Carr (Cleveland Society), was started in March. To date, over 100 return cards have been received from prospective members. These have been forwarded to the appropriate Societies for follow-up. The Membership Chairman will report to the Board at its Spring Meeting on the success of the program.

Annual Meeting and Paint Show

The 1990 Annual Meeting and Paint Show were tremendous successes. Record totals were recorded in attendance (8,693), exhibiting companies (283), and net square footage of exhibit space (82,090). The technical program, geared to the theme, "A Decade of Decision: Preparing for the Year 2000," saw high attendance at virtually every session. Beginning with an upbeat audio-visual production featuring the programs and services of the Federation, the 1990 convention was served well by the Baltimore Society (Richard Chodnicki, Host Committee Chairman) and we sincerely thank Dick and his Committee for their fine work in Washington.

Although successful, the meeting scored low on the costs to all involved. Attendees, exhibitors, and the FSCT found Washington to be well above average for expenses incurred. For this reason, and due to a potentially increasing problem with the hotel arrangements, the Federation is considering relocating the 1998 Annual Meeting to a site other than Washington, which was previously approved by the Board. Discussions are ongoing with the National Paint & Coatings Association, with whom the FSCT will meet conjunctively in 1998. Other sites are under consideration and we hope to be able to present an alternate proposal to the Board in Philadelphia.

Plans for the 1991 Annual Meeting and Paint Show are well underway. The theme, "The International Coatings Environment: Today's Opportunity, Tomorrow's Challenge," is apropos for the site in Toronto, Ontario. Program Chairman Gerry Parsons and his Committee are developing a program of presentations for the event. The Toronto Society will serve as the Host Society, and General Chairman Larry Ham and his Host Committee are ready to assist.

The Federation headquarters, Sheraton Centre, and co-headquarters, Royal York, are two of nine hotels selected to accommodate

Maureen Lein (New England) and Horace Philipp (Montreal)

attendees. Shuttle bus service will be available; however, most hotels are within walking distance of the beautiful Metro Toronto Convention Centre, in which all events will be held. To date, 243 companies have reserved exhibit space in the Paint Show, which is 98% sold out.

The Housing and Advance Registration brochure has been mailed to all members, who are urged to respond quickly.

Committee Liaison

Staff continues to work closely with the Federation's many committees, including the Corrosion, Educational, Manufacturing, Annual Meeting Program, Professional Development, and Technical Advisory Committees. Detailed reports of these and other committees' activities can be found in the report of Director of Field Services Kocis and in the individual reports of the Committee Chairmen.

Spring Week

The eighth annual "Spring Week" of the Federation will be held May 13-16 at Philadelphia's Sheraton Society Hill Hotel. The program of the seminar, "Formulating for the Future," was developed by the Philadelphia Society, and we thank the Society (Orville Brown, Chairman) for its efforts in planning this event. The seminar will be held on May 13-14.

The Board of Directors Meeting on May 15 will be preceded by a reception the evening prior at the Federation's new headquarters building. We sincerely thank the Eastman Chemical Products Co. for its support of the function, and the Mobay Corp. for hosting the reception for the Incoming Society Officers, whose meeting will be held on May 16.

Wayne Kraus (Philadelphia) and William Shackelford (Pacific Northwest)

Officer/Staff Visits

Visits since the last report have been made to the monthly meetings of the Golden Gate, Baltimore, Philadelphia, Mexico, Chicago, Montreal, Cleveland, Piedmont (by Pat Viola), and CDIC Societies in the company of an Officer. The Federation was also represented at the West Coast Societies Symposium and Show, in San Francisco; the Southwestern Paint Convention, in Dallas; the Southern Society Annual Meeting, in Memphis; and the Pacific Northwest Symposium, in Vancouver.

Other industry meetings attended were the annual meetings of the National Decorating Products Association and Mexico Association of Paint and Printing Ink Manufacturers (by President Weitz), and the Board Meeting of the National Paint & Coatings Association (by William Holmes).

Staff

We have had one addition to the Staff since the last report. Following a lengthy search, the Federation welcomed Mike Bell as Director of Educational Services, in March. Mike comes to the Federation with an excellent background in association work, serving most recently as Manager of Membership Interests for the Society of Manufacturing Engineers, in Detroit. Mike joins a staff of 15 dedicated individuals who are: Thomas Kocis (Director of Field Services); Rosemary Falvey (Director of Meetings and Conventions); Patricia Viola (Director of Publications); Charles Schmidt (Controller); Victoria Graves (Meetings Coordinator); Samuel Amicone (JCT Associate Editor); Kathleen Wikiera (JCT Assistant Editor); Lorraine Ledford (Advertising Services); Audrey Boozer (JCT Subscription Fulfillment); Linda Madden (Desktop Publishing); Dorothy Kwiatkowski, Mary Sorbello, and Lisa Torrens (Secretarial); Meryl Cohen (Order Dept.); and Marie Wikiera (Receptionist).

Robert F. Ziegler,
Executive Vice President

DIRECTOR OF FIELD SERVICES KOCIS

Committee Liaison

Major involvement continues to be in committee liaison and, as noted in the following summaries (as well as in the individual committee reports), there is much significant ongoing activity.

Educational— Steering Committee met in Cleveland on December 11, and again on March 6. Committee is currently operating on an Ad Hoc basis, pending appropriate action for incorporating within Federation By-Laws. A mission statement has been developed, along with recommended duties and staffing to duly constitute the Committee, for submission to the Executive Committee.

Scholarship funding requests for 1991-92 academic year were reviewed. Recommended appropriations were approved by Executive Committee for following institutions: California Polytechnic Institute; University of Detroit; Eastern Michigan University; Kent State University; University of Missouri-Rolla; North Dakota State University; and University of Southern Mississippi.

Continued dearth of entries in annual Southern Society A. L. Hendry Award competition (for best undergraduate-authored paper on some aspect of coatings technology) is matter of concern, and Committee is pursuing various approaches to spur student participation.

In response to Executive Committee request, plans are underway for surveying coatings executives to gather information on industry's current and anticipated personnel requirements and their necessary qualifications.

Annual update of "Guide to Coatings Courses" was published in the February issue of the *JCT*.

Meeting of Steering Committee with Society Educational Committee representatives has been scheduled for June 12, in Baltimore; focus of discussions will be on generating recommended programs for increased educational activities at the local and national level.

Corrosion — Committee met on February 25-26, in Bethlehem, PA, and toured nearby Lehigh University Corrosion Laboratory in conjunction with the meeting.

Complete report of the Committee-sponsored "Survey of Accelerated Test Methods for Anti-Corrosive Coating Performance" has been published by the Federation and made available for sale. Publication of the report marks completion of the survey project (conducted by the Steel Structures Painting Council), which the Committee believes has yielded much useful information for the coatings industry.

Major project being proposed is promoting awareness of need to upgrade industry capability in predicting corrosion resistance of coatings; this is perceived as logical follow-up to the survey, which documents the shortcomings of accelerated testing procedures currently available.

Presentations are being developed and speakers selected for symposium at 1991 Annual Meeting; topic is "Coatings for Corrosion Control of Non-Ferrous Substrates," with focus on aluminum, zinc and galvanized steel, copper and brass, and composites.

Committee is also developing program for 1992 Spring Seminar. Theme is "Understanding Corrosion Protection." The two-day event will feature four half-day modules on the following topics: Corrosion Basics; Testing Techniques; Design of Experiments and Statistical Design; and General Formulation/New Technology.

Professional Development — Committee met in Newark, NJ, on January 29-30. Work nears completion on correlation of data from membership survey. Tabulations and accompanying text are being prepared for publication in *JCT*.

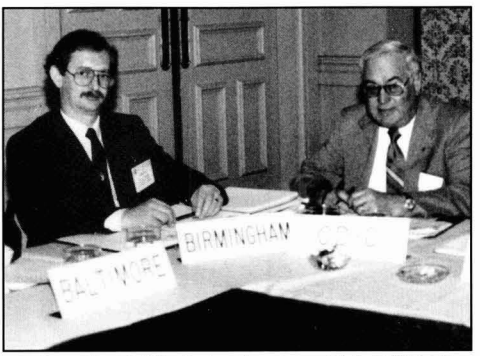
Committee again sponsoring session at Annual Meeting on "Advanced Topics in Coatings Research," featuring presentations on coatings research at the "cutting edge."

Plans are being developed for seminar on Coatings Applications: Methods and Techniques; tentatively scheduled for presentation in Spring 1992, the proposed two-day event would deal with both architectural and industrial coatings.

Extended abstracts of presentations at Committee-sponsored seminar on "Modern Analytical Resources" were produced and submitted for publication in *JCT* (published in March '91).

Another round of seminars on Statistical Process Control for Coatings was held in Chicago in March, under PDC auspices. Again conducted by Dr. Peter Hunt, this year's presentations were Level I (introductory) and Total Quality Management (with special emphasis on implementing SPC). The Level II (intermediate) seminar, and a repeat of the TQM offering had to be canceled due to poor registration. Despite the cancellations, however, the seminars continue to be well received. A total of 68 registrants attended the Level I and TQM events, and survey sheets returned by them confirm that the presentations were excellent and very informative and rewarding. Meanwhile a Level II seminar is scheduled for September 24-26 in Toronto (at Society request).

Technical Advisory — Committee met in Cleveland, on March 7. A key discussion topic was assistance to be provided in support of Federation-sponsored Proficiency Testing Program for coatings laboratories, which is conducted by Collaborative Testing Services, Inc. Basic support TAC has provided thus far are recommendations for test methods and selection of paints. It was agreed that there are aspects of the program with which the Committee is not familiar, and that if the TAC is to provide more meaningful and effective input it should have a better understanding of the CTS operation, and that the program should be reviewed in its entirety. Accordingly, three members of the Committee were appointed to visit the CTS facility in Herndon, VA, and meet with staff there for a complete and thorough discussion and evaluation of the program.



Gerry Gough (Birmingham) and Lloyd Reindl (C-D-I-C)

Additional discussion focused on plans for annual meeting with Society Technical Committee representatives, and developing ideas for promoting and maintaining interest and participation in technical project work. Meeting with Society representatives is scheduled for October 3-4.

In response to Executive Committee request, a Technical Advisory Committee member was appointed to represent the Federation at meetings conducted by the National Institute of Building Science (NIBS), for discussions on developing national guide specifications for the testing and abatement of lead-based coatings.

Joint Coatings/Forest Products — Committee met on April 1, at U.S. Forest Products Laboratory in Madison, WI. Forest Products Lab is now co-sponsor (with FSCT) of Joint Committee, supplanting the National Forest Products Association (NFPA).

The revised NFPA booklet, "Finishing Exterior Wood Products" (formerly titled, "How to Paint Your Wood House"), was recently published. Joint Committee contributed substantially to updating and editing effort for the revised publication.

Five monographs on various aspects of coatings for wood substrates have been completed and prepared for publication: Prevention of Extractive Discoloration; Moisture Control in Houses —The Effect of Interior Moisture on Exterior Finishes; Painting Recommendations for Pre-Primed Medium Density Hardboard Siding; Finishability of CCA Pressure-Treated Wood; Finish Application

William Passeno (Detroit), Timothy Donlin (Golden Gate), and James Judlin (Houston)

Raymond Uhlig (Pittsburgh) and James Husted (Piedmont)

Recommendations for Smooth, Embossed and Saw Textured Surfaces.

Coatings research projects currently being conducted by the Forest Products Lab were reviewed, and priority list of topics recommended for subsequent undertaking.

Manufacturing — Committee met on February 21-22, in Los Angeles, and toured the Dunn-Edwards facility there in conjunction with the meeting. Major agenda item was development of seminar for the 1991 Annual Meeting. Topic selected is "Waste Minimization/ Production Optimization"; format will incorporate theoretical and practical presentations in a three-hour time frame. Committee is hopeful of repeating the success of last year's seminar, which was extremely well received and attended (125 to 150 throughout).

Nominee was selected for recommendation to Morehouse Industries as 1991 recipient of Golden Impeller Award. Presented by Morehouse at Annual Meeting during manufacturing seminar, Award is for outstanding contributions to dispersion technology.

Discussions continue on project to compile articles on manufacturing topics, selected from industry publications, academic sources, and supplier firms, for reprinting and assembling in loose-leaf binder format. Industry sources are being contacted to determine availability of material. Federation funding would be required and, if project is determined feasible, appropriate request will be submitted.

Tour of ICI plant in suburban Toronto is planned for Wednesday afternoon, November 6, in conjunction with Annual Meeting; attendance will be limited to Committee members and Society Manufacturing Committee members.

Arthur Hagopian (Toronto) and Dan Dixon (Southern)

Program — Planning for the 1991 Annual Meeting program began at organizational meeting of Committee, held during 1990 Annual Meeting in Washington, and was further developed at subsequent full-day meeting, held December 5 in Cleveland. Theme selected for this year's event is "The International Coatings Environment: Today's Opportunity, Tomorrow's Challenge"; programming will emphasize the international perspective, with particular emphasis on environmentally and performance engineered products. Early indications point to a good supply of submissions, which should provide a full complement of quality presentations for the Toronto event.

MISCELLANEOUS

Continuing Staff assistance to Advisory Board in development of booklets for new *Federation Series on Coatings Technology* . . . Liaison and support provided to committee of Philadelphia Society members who arranged the program for the 1991 Spring Seminar on "Formulating for the Future." . . . Liaison and staff support also provided for activities of Roon Awards and *American Paint & Coatings Journal* Awards Committees.

THOMAS A. KOCIS,
Director of Field Services

Annual Report on Statement of Income and Expense for Year Ending December 31, 1990

The following Statement of Income and Expense for the year ending December 31, 1990 was reviewed and approved by the Board of Directors at its meeting of May 15, 1991.

It is presented here in accordance with the Articles of Incorporation under the laws of the Commonwealth of Pennsylvania.

BALANCE SHEET

December 31, 1990
Final-Audited

Assets	**1989**	**1990**
Current		
Cash	$186,257	$159,166
Investments	296,829	121,122
Hendry Southern Soc. Award	25,381	25,542
Accts Rec.—Trade	107,613	91,630
Accts Rec.—OCCA	—	—
Inv—Dictionary (12/31)	21,836	19,682
Inv—Infrared Books (12/31)	15,958	15,228
Inv—JCT Paper Stock	27,498	—
Prepaid Expense	31,135	52,361
Accrued Interest Rec. (12/31)	4,927	—
Total Current Assets	717,434	484,731
Non-Current		
Investments	1,575,245	1,583,242
Land	287,478	287,478
Building	272,124	1,203,036
Furniture & Equip.	59,489	114,447
Computer Equip.	106,508	124,847
Res for Deprec.—Computer Equip.	(56,739)	(73,264)
Exhibit Equip.—FSCT Booth	30,000	30,000
Res for Deprec.—FSCT Booth	(27,000)	(30,000)
	2,247,105	3,239,786

Other Assets		
Advances & Deposits	5,030	5,030
Value - Deferred Comp.	122,737	132,027
	127,767	137,057
Total Assets	3,092,306	3,861,574
Liabilites and Fund Balance		
Current		
Accts. Pay.—Trade	126,821	77,894
Accts. Pay.—OCCA	560	3,485
Accts. Pay.—Hendry Award	29,580	30,608
Accts. Pay. Due Contractor	78,083	—
Accrued and Withheld Taxes	—	—
Mortgage Payable	—	100,000
Sales Tax Payable	12	—
Deferred Income & Expense	234,761	357,148
Total Current Liabilities	469,817	569,135
Non-Current		
Deferred Income	8,931	6,994
Deferred Comp. Liability	77,333	85,333
Mortgage Payable	—	441,667
	86,264	533,994
Total Liabilities	556,081	1,103,129
Fund Balance	2,536,225	2,758,445
Total Liabilities and Fund Balance	3,092,306	3,861,574

Statement of Income and Expense

Income		
	1989	**1990**
Publications	745,542	741,283
Membership Dues	47,787	47,506
Annual Meeting & Paint Show	1,425,171	1,649,919
Other Educational Activities	62,224	100,296
Misc. (incl. investment interest)	194,267	154,188
Total Income	2,474,991	2,693,192
Expense		
Headquarters/Office		
Staff Administration	924,395	931,935
Publications	584,627	596,498
Annual Meeting & Paint Show	427,854	541,149
Officers/Board & Exec. Comm.	231,469	195,267
Educational Activities	162,072	175,483
Miscellaneous	15,450	35,516
Total Expenses	$2,345,867	$2,475,848

Coatings Industry Education Fund

The Trustees of the CIEF met on Tuesday, October 30, 1990 at the Sheraton Washington Hotel, and on Thursday, January 24, 1991, at the Federation offices in Blue Bell. Items of current or continued interest include:

Artura Ita (Mexico) and Carlos Dorris (Dallas)

Elections of Officers—George R. Pilcher was re-elected as President, and Mary G. Brodie was elected as Vice President. Colin D. Penny, Secretary-Treasurer of the Federation, serves in this same capacity for CIEF. Trustees for 1990-91 are: Richard J. Himics (At-Large); Neil S. Estrada (Chairman, Investment Committee); Donald Boyd (Chairman, Educational Committee); Gail Pollano (Chairman, Technical Advisory Committee); Roger Woodhull (Chairman, Professional Development Committee).

The Joseph A. Vasta Memorial Scholarship Fund—The Fund, which currently stands at nearly $39,000, was scheduled to be given in 1990 to the University of Detroit. Unfortunately, no acknowledgment to any of the Federation office's correspondence has been forthcoming. R.F. Ziegler agreed to make a personal telephone call to ascertain "what's going on," and—if he does not receive a satisfactory response—the scholarship will be withdrawn. Also, due to the sizable amount of the Vasta fund, the Treasurer was asked to see that these funds are broken down separately on the CIEF financial statements.

Additional Scholarship Concepts—The Trustees are actively discussing the potential for funding a scholarship similar in concept to the Vasta Fund, but which might represent a memorial tribute to a larger number of deceased Society members. This "Memorial Scholarship" might be funded either from donations made by friends, family and colleagues, or possibly in the form of "living bequests," made by members in the form of insurance policies, gifts, etc. Colin Penny is drafting a revised proposal for presentation at the Trustees Meeting on May 14, in Philadelphia.

Scholarship Grant to Waterloo—The Trustees voted at the January Meeting to award $6000 in scholarship funds to the Institute for Polymer Research at the University of Waterloo. This is in support of their graduate program, and represents a one-time commitment, although CIEF will consider annual requests for renewal on a merit basis.

Equipment Grant to Lowell—The Trustees voted at the January meeting to award a one-time grant of up to $8000 to the University of Lowell, for purchase of equipment to establish a basic Coatings Laboratory. This would enable Lowell, which has heretofore offered only lectures and seminars on coatings topics, to offer laboratory courses, as well. Anticipated equipment purchases would include items such as an impact tester, gloss meter, conical mandrel, grind gauge, abrasion tester, etc.

Future Directions for CIEF—John Oates, representing the Planning Committee, discussed with the Trustees, at the January meeting, the possibility of having CIEF assume the responsibility for the administration of all FSCT scholarship funds, thus freeing-up the Educational Committee for more narrowly-focused, proactive

Sarah Oebser (Northwestern) and Richard Himics (New York)

projects. Discussions will be on-going. In the meantime, in keeping with its mandate to "advance the knowledge of the Chemical, Physical, and Mathematical Sciences relating to the knowledge of coatings by supporting research at colleges and universities . . ." and to "aid in the dissemination of the results of such research," the CIEF will consider innovative proposals by both North Dakota State University and Eastern Michigan University at their May Meeting.

GEORGE R. PILCHER,
President

Review of Actions Of Executive Committee

(One of the duties of the Board of Directors is to approve or disapprove the actions of the Executive Committee.

The actions of the Executive Committee of October 31, 1990 and January 25, 1991 were included with the minutes mailed previously to the Board Members. The actions of May 14, 1991 were distributed at the meeting.)

OCTOBER 31, 1990

That it be recommended to the Board that the proposed revision to By-Laws Art. III, Sec. D, Para. (4), regarding a change in status of Retired Members, not be endorsed for passage.

That the staff salary budget for 1991 be set at $518,000.

That, as a matter of policy, incoming members of the Executive Committee be invited to attend the committee meeting held prior to the Fall Board Meeting, and that the salary budget be discussed.

(On a motion by Mr. Van Zelm, seconded by Mr. Geiger, the actions of the Executive Committee for October 31, 1990 were unanimously approved.)

JANUARY 25, 1991

That the estimated income and expense statement for 1990 be approved. (Income—$2,684,267; Expense—$2,447,982.)

That, due to significant increase in expense incurred by attendees at the 1990 Annual Meeting and Paint Show, the Executive Vice President be authorized to investigate alternate sites for the 1998 Annual Meeting and Paint Show.

That the proposal from Sanyo Shuppan Boeki Co., Inc., Tokyo, Japan, for the exclusive distribution of the revised *Infrared Atlas* in Japan be approved.

That the request from the National Institute of Building Sciences regarding support for the development of guide specifications for testing and abatement of lead-based paint be approved; and, that the FSCT Technical Advisory Committee be suggested as the NIBS contact.

That the U.S. Forest Products Laboratory be endorsed as a co-sponsor of the Joint Coatings/Forest Products Sub-committee.

That the Policy of FSCT Staff Performance and Development Appraisal, as written by Staff, be approved.

That, upon the recommendation of the FSCT Pension Administrator, the FSCT adopt a defined contribution pension plan for staff employees.

That the request to sponsor a Statistical Process Control Level II course in Toronto in 1991, be approved, with the provision that the Toronto Society guarantee a minimum of 25 attendance.

That the request to support the Mississippi Alliance for Minority Participation program be respectfully declined.

That the budgeted grant to the Steel Structures Painting Council be increased to $2,000 for 1991.

That President Kurt Weitz represent the Federation at the 1991 annual conference of the Surface Coatings Association Australia, in Melbourne, on August 8-10.

That President Kurt Weitz and Executive Vice President Robert Ziegler represent the Federation at the 1991 annual conference of the Oil & Colour Chemists' Association, in Stratford-upon-Avon, England, on June 12-14.

That the 2000 Annual Meeting and Paint Industries' Show be held in Chicago, on October 18-20.

That the report of the Liaison Committee be accepted, and that its request for gaining closer ties to the SCAA by offering complimentary subscriptions to the JOURNAL OF COATINGS TECHNOLOGY to SCAA Officers and Committee Chairpersons be approved.

That the protocol for the nominations of Federation Officers/Executive Committee/Board Members, as developed by the Planning Committee, be approved.

That the recommendations of the Investment and Finance Committees be approved, along with the Operating Budget for 1991; Income—$2,654,000; Expense—$2,654,000.

(On a motion by Mr. Shackelford, seconded by Mr. Uhlig, the actions of the Executive Committee for January 25, 1991 were unanimously approved.)

MAY 14, 1991

That the Income and Expense Statement for the First Quarter 1991 showing Income at $1,702,888 and Expense at $701,831 be approved.

That the city of New Orleans be recommended as the site of the 1998 Annual Meeting and Paint Industries' Show.

That the Federation Manufacturing Committee be encouraged to develop mechanisms to increase Constituent Society involvement of local manufacturing personnel.

That the report of the Accounts Review Committee be accepted as amended, and that the duties of the Committee be incorporated by the By-Laws Committee into the duties of the Finance Committee.

That the report of the Planning Committee be accepted and that the Committee be directed to develop detailed plans for appropriate educational expenditures.

Based on the stated duties of the Finance Committee, the Executive Committee recognizes the redundancy of the Investment Committee and recommends to the Board that the Investment Committee be dissolved.

That President Weitz attend the annual meeting of the OCCA-New Zealand on August 1-4, in conjunction with his visit to the annual meeting of the Surface Coatings Association Australia on August 8-10.

That the Mexico Society request to translate the *Federation Series on Coatings Technology* booklets into Spanish be accepted with the provision that the Federation retain control and distribution of the translated material.

That the 1991 Union Carbide Coatings Technology Award be presented to the members of the Federation Working Committee for the *Infrared Spectroscopy Atlas*.

That the request of Eastern Michigan University for support of its seminar for high school chemistry teachers be approved with a $1,000 grant and matching funds by the FSCT to any monies donated by the Detroit Society.

That the Federation offer advertising of SCAA's coatings technology textbook in appropriate FSCT publications.

That the recommendations by the Ad Hoc Educational Steering Committee be accepted and that the By-Laws Committee draft appropriate language to enact the Educational Coordinating Committee as a committee of the FSCT.

That McGettigan Travel, of Philadelphia, be approved for travel agency service to the Federation and its membership.

(Discussion was held regarding three actions of the Executive Committee: (1) The functions and duties of the Ad Hoc Accounts Review Committee were detailed by Mr. Pawsey, Chairman of the Committee: The Committee performs as an oversight committee on reviewing FSCT accounting systems and suggesting improvements or changes; and, in assisting in the indoctrination of the newly-elected Secretary-Treasurers in the performance of their duties.

(2) Regarding the Executive Committee proposal to amend Standing Rule Article SR VIII, dismissing the Investment Committee and transferring its duties to the Finance Committee, Mr. Schwab requested clarification on the limits of staff responsibility. Mr. Penny responded for the Executive Committee by stating that the Chairman of the Finance Committee would have final authority for transferral of funds to investment accounts, but that the Chairman would rely to some extent on the advice and counsel of the Executive Vice President and Controller. He noted that the recommendation included the addition of the Controller as an ex officio member of the Finance Committee. Mr. Hoeck expressed the opinion that both the Executive Vice President and the Controller be bonded to ensure the FSCT against the improbable, but possible, situation of improper conduct. [Subsequent investigation showed that all staff employees are bonded.] Mr. Estrada, Chairman of the Investment Committee, indicated that the proposal was similar to one made several years ago by the Federation's independent auditing firm.

(3) Discussions on the proposal of the Ad Hoc Educational Steering Committee to institute an Educational Coordinating Committee centered on the composition of such a committee and whether representatives of CIEF and the Professional Development Committee were necessary. It was determined that they were.

On a motion by Mr. Hon, seconded by Mr. Shackelford, the actions of the Executive Committee for May 14, 1991 were unanimously approved. Amendments to Standing Rules require only one reading, therefore, with passage of these actions, the Investment Committee was dismissed and its duties transferred to the Finance Committee.)

By-Laws

Proposed Amendment: Retired Membership

SECOND READING

The Board of Directors requested that the By-Laws Committee consider a proposal to extend to a Retired Member all of the rights and privileges to which the member had been entitled at the time of retirement. This would extend the eligibility for serving as a Federation Officer, Board Member, Society Representative, or Committee Chairman to a retiree who was in an eligible class of membership at the time he or she retired.

After due consideration, the By-Laws Committee proposed the following amendment for the first reading at the Fall 1990 Board of Directors Meeting:

Be it RESOLVED that:

By-Laws Article III, Section D, Paragraph (4) RETIRED MEMBERSHIP be amended as follows:

Add the Following Paragraph:

"A Retired Member shall be entitled to exercise all rights and privileges to which such member was entitled based on his or her class of membership at the time of retirement."

Note: The By-Laws Committee made no recommendation.

This proposed amendment passed its first reading at the October 28, 1990 meeting.

At their October 31, 1990 meeting, the Executive Committee discussed the first reading of the proposed revision to By-Laws Art. III, Sec. D., Para. (4) concerning the change of status of Retired Members. The Committee is concerned that, with the proposed change giving Retired Members, who were formerly Active Members, full, participatory status in Federation governing bodies, there may be a lack of new ideas and energy. They also believe that there are other ways for retirees to remain active in FSCT affairs without the need for legislating permanent active status. Upon motion, it was unanimously approved that the Executive Committee recommend to the Board that the referenced revision to the By-Laws not be endorsed for passage at the second reading.

FRED G. SCHWAB,
Chairman

(On second reading, the proposed amendment was defeated by a vote of 7 affirmative, 21 negative, with 7 members abstaining.)

Nominations

The Nominating Committee proposes the following slate of candidates to the Board of Directors for the 1991-1992 term:

President-Elect: Colin D. Penny, Baltimore Society (Hampton Paint Manufacturing Co., Inc.). One-year term.

Secretary-Treasurer: John A. Lanning, Louisville Society (Courtaulds Coatings, Inc., Porter International Div.). One-year term.

Executive Committee: Joseph D. Giusto, Baltimore Society (Lenmar, Inc.). Three-year term.

Board of Directors (Members-at-Large): Orville E. Brown, Philadelphia Society (M.A. Bruder & Sons, Inc.); J.D. "Dick"

Thad Broome (Southern) and John Lanning (Louisville)

John Ballard (Louisville) and Gerald Ivancie (Western New York)

Mullen, Rocky Mountain Society (G-3 Industries). Two to be elected; two-year terms each.

Board of Directors (Past-President Member): James E. Geiger, Southern Society. Two-year term.

I thank the members of the Nominating Committee (Past-Presidents Terryl F. Johnson and John Oates, and Society Representatives Fred Schwab and Ray Uhlig) for their assistance in selecting these candidates.

JOHN C. BALLARD,
Chairman

(There were no nominations from the floor. Elections will take place during the November 3, 1991 Board Meeting, in Toronto, Ontario.)

Report of the Ad Hoc Office Building Committee

James Geiger, Chairman, thanked the Board Members for attending the Open House held at FSCT headquarters the previous evening and for their support of the Committee's efforts in the planning and construction of the new facility. He also thanked his Committee members [Past-Presidents James McCormick (Baltimore), John Oates (New York), Deryk Pawsey (Pacific Northwest), and current Secretary-Treasurer Colin Penny (Baltimore)] for their dedication to this important project. Mr. Geiger advised the Board that the Committee's work was completed. President Weitz sincerely thanked the Committee and, following a round of applause from the Board, dismissed the group.

JAMES E. GEIGER,
Chairman

Society Business

AWARDS TO SOCIETY MEMBERSHIP CHAIRMEN

FSCT Membership Chairman Brenda Carr announced that awards of appreciation for exemplary membership increases during the year 1990-91 were won by the Membership Chairmen of Rocky Mountain, Piedmont, and Toronto Societies. The Rocky Mountain Society increased its membership by 52.6%, Piedmont by 31.6%, and Toronto by 12%, within their respective size categories. Honorable Mentions went to the St. Louis, Louisville, and Southern Societies. Ms. Carr congratulated these Societies and presented Certificates of Appreciation to their representatives attending the meeting.

TORONTO SOCIETY

Mr. Hagopian requested that the Board consider establishing a student rate for the Federation's Annual Meeting. He noted that students in the Toronto area are planning to attend this year's Annual Meeting and that the Society will subsidize their attendance fees.

(Following a discussion of the specific fee, Mr. Hagopian moved that the Federation allow full-time students to attend the Annual Meeting at a one-day registration fee of $10. The motion was seconded by Mr. Penny and unanimously approved.)

LOS ANGELES

Mr. Van Zelm updated the Board on the status of the coatings program at Cal Poly-San Luis Obispo. He noted that the first graduate of the program is now working in the industry. Funding for the program was increased this year due to a memorial golf tourney in which 99 players participated and over $7,000 was raised.

PIEDMONT

Mr. Husted presented a history of the Society compiled in accordance with the request of the Ad Hoc FSCT History Committee (Michael Malaga, Chairman). The Board was requested to check with their respective Societies to determine the status of their own efforts.

CLEVELAND

Mr. Schwab requested that Staff revise the Annual Meeting awards to include a Society Speakers Award certificate in addition to the cash prizes, and to note the award placement on the A.F. Voss/APJ Award certificate. Mr. Ziegler noted the request and advised that these suggestions will be accomplished.

HOUSTON

Mr. Judlin presented the Society's donation of $181 towards the manufacture of the FSCT logo recently installed at FSCT Headquarters. President Weitz thanked the Society for its generous donation and noted that several Societies had made contributions to the logo.

PHILADELPHIA

(The Philadelphia Society report, which was to have been included with the Fall Board of Directors Report [JCT, January, Vol. 63, No. 792, 57 (1991)] was inadvertantly omitted. The report is published here in its entirety. We apologize for any inconvenience—Ed.)

The Philadelphia Society has experienced a 13.3% increase in membership . . . During 1989-1990, the Society held eight regular business meetings as well as eight Technical Committee meetings which featured technical presentations . . . The Technical Committee held successful seminar on "Advances in Technology to Meet New VOC Regulations" . . . Ongoing Technical Committee projects include "Defining the Validity of ASTM D 2369-87 Non-Volatile Determination of Low VOC Coating Systems" and "Developing a Computerized Data Base of Raw Materials Physical Properties." Society-sponsored coatings course on "Introduction to Coatings Technology" was conducted at Northeastern Christian Junior College, affiliated with Lehigh University. Dr. Richard Granata, of Lehigh University, served as course administrator and Tom Brown, of Consultants Consortium, was course instructor . . . The Liberty Bell Award, the Society's highest honor, was presented to Don

Denny, of E.W. Kaufmann Company. Dr. Granata and Dr. Brown received the Society's Technical Award, and Orville Brown was presented with Past-President's Award . . . The Society is anticipating serving as hosts for 1991 Spring Week events.

New Business

FEDERATION HONORARY MEMBERSHIP

Elected to Honorary Membership at the Fall 1990 Annual Meeting, Neil S. Estrada was presented with the Federation Honorary Membership Certificate at the current meeting of the Board of Directors. Mr. Estrada remarked on the honor being bestowed on him and thanked the Federation for the opportunities to contribute to the organization and the industry over the years.

Committee Reports

ANNUAL MEETING HOST

The 1991 Host Committee has been assembled and includes the following Subcommittee Chairmen: General Chairman—Larry Ham, Stochem, Inc.; Information Services—Sandy Palleschi, Serif Coatings; Program Operations—Scott Harvey, Chemroy Chemicals; Registration—Gord Major, Bethco Consultants; FSCT Exhibit—Art Hagopian, Bapco, Inc.; Spouses Program—Marion Gauley, L.V. Lomas Chemicals; FSCT Suite—To Be Announced.

The first meeting of the Host Committee was held on Tuesday, February 12, 1991 and was attended by all of the Subcommittee Chairmen mentioned above. In addition, Kurt Weitz, FSCT President, was present and provided many helpful suggestions.

The job functions of each of the subcommittees were reviewed and the chairmen were encouraged to contact the former Washington Subcommittee Chairman for advise.

All of the subcommittees have begun to assemble their staffs and initial responses have been very positive.

Since the February 12th meeting, we have appointed a Chairman for the FSCT Suite subcommittee.

We will be looking to the Federation Staff for some specific direction and have planned our next meeting for Wednesday, May 1, 1991.

LARRY T. HAM,
Chairman

ANNUAL MEETING PROGRAM

The 1991 Annual Meeting Program Committee first met on October 29, 1990, during the Washington Annual Meeting. During this meeting we agreed the 1991 Annual Meeting should encompass the paint industry on an international scale. Since the location of the Paint Show was outside the U.S., an international theme would be pursued.

Our second meeting was held on December 5, 1990 at the Sheraton Hopkins Airport in Cleveland. After some time spent refining various approaches, to develop the proper wording, the theme chosen was "The International Coatings Environment: Today's Opportunity, Tomorrow's Challenge."

Today's global coatings environment requires pro-active marketing and technology strategies. An opportunity today will be a challenge tomorrow if not addressed in a timely and effective manner. To address the theme, programming will emphasize the international perspective and will focus on such areas as quality improvement, cutting edge technology, and environmentally and performance engineered products.

The Committee will develop several sessions dealing with the theme variations to assure that it will be adequately addressed in the programming. Topics were assigned and responsibilities assigned for:

Quality Improvement—John Lanning; Free Trade Session—John Hall; Personnel Training/Education was being considered—Mary Brodie to liaise with Educational Steering Committee; Environmentally and performance engineered products will be covered in response to "call for papers" and Roon Awards competition. Peter Hiscocks and Rob DeRuiter will moderate these sessions; Cutting edge technology would be covered in Professional Development Committee who will sponsor session on Advanced Topics on Coatings Research. Roger Woodhull will coordinate this topic.

With these various presentations the theme will be carried throughout the program.

We have received 13 abstracts which could result in papers suitable for presentation. These prospective presenters have been requested to submit papers to the Program Committee by May 15, 1991. Each member of the Program Committee will read and comment on the suitability of each paper for our program.

Several FSCT Committees are putting together half day sessions for the 1991 Program. The Corrosion Committee is planning a session entitled "Coatings for Corrosion Control of Non-Ferrous Substrates." The Manufacturing Committee's session will be "Waste Minimization/Production Optimization."

In addition to these sessions, we expect to have four to six Society papers, around 10 Roon papers, and possibly three papers on Powder Coatings. We expect a program of approximately 48 papers.

Our goal is to have the program finalized by July 1, 1991.

We are excited about our program and anticipate new opportunities and challenges will be achieved.

GERRY PARSONS,
Chairman

EDUCATIONAL

Ad Hoc Educational Steering Committee: The Educational Steering Committee, which evolved from an informal arrangement to administer and guide the efforts of the full Educational Committee, has never been formally authorized, and is currently operating on an Ad Hoc basis. This guiding Committee met twice at the Sheraton Hopkins Airport Hotel, Cleveland, OH, December 11, 1990, and March 6, 1991. The Committee is composed of the following members: Paul Baukema (Louisville); Ted Fuhs (Chicago); John Gordon (Los Angeles); Carl Knauss (Cleveland); Sid Lauren (New England); Gerry Mattson (Southern); John Oates (New York).

Much of our discussion focused on the mission and recommended duties and staffing of this guiding Committee. Appropriate

Richard Hille (Chicago) and Fred Schwab (Cleveland)

recommendations are being brought to the Executive Committee for review.

Scholarship Funding: Funding recommendations for Federation scholarship programs for the academic year 1991-92 were made and approved by the Executive Committee. Scholarship funds will be made available to the following institutions: California Polytechnic Institute; University of Detroit; Eastern Michigan University; Kent State University; University of Missouri-Rolla; North Dakota State University; University of Southern Mississippi.

Hendry Award Competition: During the last few years, there has been a scarcity of papers submitted for the Southern Society A. L. Hendry Award competition. This is a matter of concern for the committee and various approaches to stimulate interest are being pursued. The award is for the best undergraduate-authored paper on some aspect of coatings technology. Our action plan includes more active publicity and an added unrestricted grant for furthering undergraduate efforts in the sponsoring professor's laboratory.

Proposed Survey of Coatings Industry Technical Needs: In response to an Executive Committee request, the Educational Steering Committee is developing plans for a survey of coatings executives to gather information on the industry's current and anticipated personnel requirements and their necessary qualifications. We are hoping to enlist the NPCA in this effort.

Annual Meeting of the Full Educational Committee: The Steering Committee has scheduled a meeting of the full Educational Committee, comprised of Society Educational Committee representatives, for June 12, 1991, in Baltimore, MD. We feel that the mission of the Educational Committee must be to foster and support education/information activities in the local Societies. It is especially important for us to have participation by local representatives at this critical time of redefinition. We have an exciting, activity-oriented program planned.

Future Directions: The Planning Committee has been actively searching for a more pro-active Federation policy towards Education. John Oates has kept us abreast of their work. We feel that the Educational Committee must be oriented and responsive to the educational/informational programs of the local Societies, providing leadership and program material. We have been discussing a move of FSCT scholarship funding, in conjunction with a concerted program to address college and university activities, to the CIEF. Continuation of the excellent programs by the Professional Development Committee focused on education of our existing membership is another component. We of the Educational Committee and a duly constituted Steering Committee are looking forward to expanding the resources and the programming for education within the Federation.

DONALD W. BOYD,
Chairman

Louis Holtzknecht (Louisville), Berger Justen (Southern), and Deryk Pawsey (Pacific Northwest)

ENVIRONMENTAL AFFAIRS

The Environmental Affairs Committee consists of the Chairman, nine (9) members from U.S. Societies and one (1) member from Canada. Each month the Regulatory Update information is sent from NPCA to Pat Viola who, in turn, sends it to three members of the Committee plus the Chairman. This is edited and returned to Federation headquarters for inclusion in the *JCT*.

SIDNEY J. RUBIN,
Chairman

INTER-SOCIETY COLOR COUNCIL

There has been no activity of this Committee since the fall 1990 meeting.

Very recently, Hugh Fairman, President of ISCC has requested that if the Federation decides to hold a SCAI conference in 1994 that we consider a joint meeting with ISCC.

RALPH STANZIOLA,
Chairman

MANUFACTURING

We held our Spring Meeting on February 21 and 22, 1991 at the Sheraton Plaza La Reina Hotel in Los Angeles, California.

Art Hagopian (from ICI, Canada) was welcomed as a new Committee member.

We visited the Dunn-Edwards paint plant and observed their new Quick-Tint facility in operation. Committee members were impressed with the high degree of automation coupled with flexibility that is incorporated in the design. Ken Edwards and Gill Mislang, who conducted the tour, were open and forthright in their responses to our questions and comments.

All committee members agreed that the plant tours are worthwhile activities for the committee and that wherever possible we will try to arrange tours in conjunction with any required meeting.

We reaffirmed our commitment to developing the *Manufacturing Digest*. It was decided that a Subcommittee would be the most effective approach. Mike Hasser and Scott McKenzie, assisted by the Committee Chairman will comprise the Subcommittee. A solicitation letter is being sent to suppliers for articles and/or copies of talks. Contributions received will be reviewed by the Subcommittee via round robin.

The Subcommittee will meet in Atlanta on August 1 and 2, 1991 to review comments and determine the next step.

The Atlanta meeting will also serve as the speaker coordination meeting for the 1991 seminar. Additionally, those members attending will tour the Glidden facility at Gainesville, Georgia.

The next item on our agenda was a critique of the 1990 seminar. It was agreed this was our best ever. Peak attendance was 250, with the full seminar never having less than 120-150 attendees. The format of Theoretical/Practical, with a proponent presenting the concept and an implementer reporting the application, has been well received and will be followed whenever possible.

Primary focus of the spring meeting is to develop the Committee-sponsored seminar for the Federation Annual Meeting. The topic chosen for presentation this year in Toronto is "Waste Minimization/ Production Optimization." The proponent speaker will be Charles Rooney, from Orr and Boss, with the implementers being Al Crego, from The Glidden Co. (Gainesville, GA), and another speaker, yet to be selected. Following the presentation, the speakers will assemble as a panel for an open question and answer forum. We have requested the three-hour time slot from 9:00 a.m. to 12:00 (noon) on Tuesday, November 5.

It was suggested that the Manufacturing Committee consider sponsoring a Waste Reduction contest in the industry. However, as the NPCA has announced a similar program, we have decided to forego any involvement.

Our final action was the unanimous selection of a nominee to receive the 1991 Morehouse Golden Impeller Award, for outstanding contributions to dispersion technology. The nomination has been forwarded to James Swartout, of Morehouse, who concurs wholeheartedly. Presentation of the Award will be made during the Manufacturing Seminar at the Annual Meeting.

On behalf of this Committee I would like to thank the Federation for its support and commitment to our goals; and the Federation Staff for its assistance in reaching those goals.

ANNE M. PROBIZANSKI,
Chairman

MEMBERSHIP

New "Benefits of Membership" Brochures with a response card were generated. New "Federation Publications" brochures were also generated.

Both brochures are being used in the membership drive directed at non-member attendees of the Paint Show.

A design for a new application form has been submitted to the Federation Staff for consideration.

Also, a brochure entitled "Why Renew" has been designed and is also in the hands of Federation Staff. This should be ready by July so it can be enclosed in local renewal requests.

Winners of the FSCT Membership awards are as follows: Rocky Mountain—52.6% (up to 200); Piedmont—31.6% (200-300); Toronto—12%,(over 300); St. Louis—13.8% (Honorable Mention Up to 200); Louisville—13.1% (Honorable Mention 200-300); Southern—9.6% (Honorable Mention Over 300).

BRENDA L. CARR,
Chairman

PROFESSIONAL DEVELOPMENT

The Professional Development Committee's activities in 1991 to date have included SPC Seminars, the Membership Survey, preparation for the PDC Symposium at the 1991 Annual Meeting, preliminary work on a seminar on Coatings Application and Substrates, and other projects.

(1) *SPC Seminars*: A Level I SPC seminar was held in Chicago on March 11-12, 1991, in conjunction with a Total Quality Management seminar on March 13. A total of 45 registrants attended the Level I program, and 23 participated in the TQM module, both conducted by Dr. Peter Hunt. The Level II seminar, and a second TQM seminar, which had been scheduled for the week of March 18, 1991, were cancelled due to poor registration. Although the cancellations were a disappointment, the seminars continue to be well received. The critique sheets returned by registrants reflect interest in continued presentations of both Level I and II, as well as advanced SPC seminars, and characterized the content of the seminars as very informative and rewarding.

Meanwhile, the Toronto Society is planning to sponsor a Level II seminar during the week of September 23, 1991, and Dr. Hunt will present his new one-day seminar on "Motivation" in Chicago on June 5, 1991, under the sponsorship of the Chicago Society and the Chicago Paint and Coatings Association.

(2) Work on the PDC/FSCT Membership and Career Survey tabulations, being conducted by Mary Brodie, nears completion. The results will be published in two parts, one detailing the survey data, and the other highlighting the important correlations. The data summary should be submitted to the *JCT* in May or June, and the correlations later this year. Each Constituent Society will receive copies of the data tabulations.

Norman Hon (Kansas City), Jan Van Zelm (Los Angeles), and James Hoeck (Louisville)

(3) The PDC Symposium at the 1991 Annual Meeting in Toronto, on "Advanced Topics in Coatings Research," is being developed by Committee members Clifford Schoff and Rose Ann Ryntz.

(4) The PDC is developing a seminar focused on Coatings Application, Methods and Substrates for possible scheduling in early 1992.

(5) *Other Projects*: The PDC authorized members of the New York Society to investigate the practicability of producing a videotape of Saul Spindel's presentation at the 1990 Annual Meeting on "Results of Good and Bad Testing."

The PDC is recommending to the Executive Committee that consideration be given to videotaping selected talks presented at the Annual Meeting. The PDC is investigating various ways to help Constituent Societies upgrade programs at monthly meetings.

ROGER W. WOODHULL,
Chairman

PUBLICATIONS

Since our last report, the following items of interest are noted:

The flow of manuscripts is good. Review procedures have been effective in minimizing the time from receipt to return to the author. We are also soliciting papers from ACS and other meetings and symposia.

We are working on the publication of seminal papers to provide archival papers for our readers. We have one key topic identified and will be planning to publish this year. A number of key papers have been identified and we hope to proceed on this as an added service to our readers.

Sixteen Federation Series Manuscripts have been published; the latest being "Introduction to Coatings Technology" by Alan Brandau of Consolidated Research, Inc. "Cationic Radiation Curing" is now being ready for publication and is due shortly. "Rheology" is due by year's end. Several other manuscripts are expected to be in the Editors hands by late summer.

Book Reviews, Humbug from Hillman and the Crossword Puzzle are on-going features and well received.

The *Infrared Spectroscopy Atlas* is expected this year and should be a valued asset for the Federation and the Coatings Industry.

Plans for a joint meeting of the Editorial Review Board and Publications Committee are being finalized and should take place in early May.

The Chairman expressed his appreciation to the members of the Committee and the Federation Staff for their contributions.

THOMAS J. MIRANDA,
Chairman

Guests in attendance included Flora Wong (Pacific Northwest), Bruce Bridges (Montreal), Neil Estrada (Golden Gate), Don Boyd (Pittsburgh), and John Oates (New York)

TECHNICAL ADVISORY

The Technical Advisory Committee met on March 7, 1991, in Cleveland, with all Technical Advisory members in attendance.

Discussions focused on the following agenda items:

Proficiency Testing Program—Status of the Proficiency Testing Program, conducted under Federation sponsorship by Collaborative Testings Services, Inc., was discussed at length. Aimed at improving the reliability of paint and coatings laboratory testing and developing reproducible test methods, the program was introduced in 1984 and has been conducted by CTS since its inception. Approximately 50 laboratories are currently enrolled, a number which has remained fairly constant since the program began.

Technical Advisory Committee members agreed that there were aspects of the program with which the Committee was not familiar, and that if it were to provide meaningful and effective input it should have a better understanding of the CTS operation, and that the program should be reviewed in its entirety.

A meeting will be held with the CTS staff at its Herndon, VA, facility to discuss the program. Topics of discussion will include selection of tests to run, testing procedures, selecting paint samples, interpretation and reporting of test results, as well as promoting the program to attract more participating laboratories. Three Technical Advisory Committee members will attend the meeting.

Meeting with Society Technical Representatives—A definitive meeting date, October 3-4, 1991, was set for the meeting of Technical Advisory Committee with Society Technical Committee representatives. Several location and plant tour sites were discussed. The exact location will be finalized by June, 1991.

In addition, the meeting format was discussed, to better utilize the time available. Discussions centered on the brainstorming session for suggested project work (how to better use the ideas generated), new and special reference material for incoming Technical Committee representatives, and information on preparing technical presentations and papers.

Each Committee member was also assigned specific Societies, with whom he/she will work closely, and serve as a consulting resource.

NIBS Project—Technical Advisory Committee members, in response to an Executive Committee request, agreed to appoint a member to serve as Federation representative to the National Institute of Building Sciences (NIBS) program to develop national guide specifications for the testing and abatement of lead-based coatings. Edward Ferlauto was selected as the Committee representative.

Future Role of Technical Advisory Committee—Discussions included a number of suggested activities, including Committee-sponsored session at FSCT Annual Meeting, workshops on how to undertake successful technical projects (including developing liaison with nearby colleges to utilize them as project collaborators).

GAIL POLLANO,
Chairman

TECHNICAL INFORMATION SYSTEMS

The Technical Information Systems Committee has completed the Keyword/Subject Index for the 1990 issues of the JOURNAL OF COATINGS TECHNOLOGY. This index was published in the December 1990 issue of the *JCT*.

The Committee is currently preparing the index for the 1991 issues.

HELEN SKOWRONSKA,
Chairman

The next meeting of the Board of Directors will be on Sunday, November 3, at 9:00 a.m., in the Sheraton Centre Hotel

Regulatory UPDATE

AUGUST 1991

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

Department of Justice
U.S. Drug Enforcement Administration
June 14, 1991—56 FR 27472
Importation and Exportation of Precursors and Essential Chemicals
Action: Notice of proposed rulemaking

The U.S. Drug Enforcement Administration (DEA) will amend its regulations under the Chemical Diversion and Trafficking Act (CDTA) to grant regular supplier or regular customer status for three of the listed essential chemicals [acetone, 2-Butanone (MEK), toluene] when regular supplier or regular customer status has already been established for one of these chemicals.

The DEA has determined to amend the regulations because the chemicals are frequently interchanged with each other, and by implementing the change, the regulatory requirement on the chemical industry would be significantly reduced without changing the effectiveness of the CDTA. Additionally, the DEA is waiving the 15-day advance notice requirement for chemical importers and exporters providing that regular supplier and regular customer status has been established for any one of these chemicals.

Written comments and objections will be accepted until August 13, 1991, and should be sent in quintuplicate to the Administrator, Drug Enforcement Administration, Washington, D.C. 20537, Attention: DEA Federal Register Representative/CCR. For further information, contact G. Thomas Gitchel, Chief, Liaison and Policy Section, Office of Diversion Control, U.S. DEA, Washington, D.C. 20537, (202) 307-7297.

Department of Justice
U.S. Drug Enforcement Administration
June 14, 1991—56 FR 27471
Records and Reports of Listed Chemicals and Certain Machines
Action: Notice of proposed rulemaking

The DEA has announced that it will amend its regulations implementing the Chemical Diversion and Trafficking Act (CDTA) to include additional chemicals as mandated by the Crime Control Act of 1990. As required by the CDTA, any handler of these listed chemicals must comply with the requirements set forth in 21 CFR parts 1310 and 1313. The newly listed chemicals and threshold amounts (by base weight) are as follows:

1. Methylamine and its salts	1 kilogram
2. Ethylamine and its salts	1 kilogram
3. D-lysergic acid, its salts, optical isomers, and salts of optical isomers	10 grams
4. Propionic anhydride	1 gram
5. Insosafrole (Isosafrole)	4 kilograms
6. Safrole	4 kilograms
7. Piperonal	4 kilograms
8. N-methylepherdine, its salts, optical isomers, and salts of optical isomers (N-methylephedrine)	1 kilogram
9. N-ethylephedrine, its salts, optical isomers, and salts of optical isomers	1 kilogram
10. N-methylpseudoephedrine, its salts, optical isomers, and salts of optical isomers	1 kilogram
11. N-ethylpseudoephedrine, its salts, optical isomers, and salts of optical isomers	1 kilogram
12. Hydriotic acid (57%) (hydriodic acid) (reflects reclassification as a precursor rather than essential chemical	1.7 kilograms (or 1 liter by volume)

For further information, contact G. Thomas Gitchel, Chief, Liaison and Policy Section, Office of Diversion Control, U.S. DEA, Washington, D.C. 20537, (202) 307-7297.

Environmental Protection Agency
May 23, 1991—56 FR 23605
Copper Phthalocyanine Pigments; Toxic Chemical Release Reporting; Community-Right-to-Know
Action: Final rule

For the purposes of 1990 and future reporting requirements, U.S. Environmental Protection Agency (EPA), by promulgating a rule, is relieving facilities of their obligation to report on releases of Pigment Blue 15, Pigment Green 7, or Pigment Green 36. Effective June 24, 1991, EPA promulgated a final rule to delete these pigments from reporting requirements under the category "copper compounds" from the list of toxic

chemicals under section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA).

EPA promulgated the rule based on its determination that, "the copper ion cannot reasonably be anticipated to become available at a level which induces toxicity from any of these pigments; and there is no evidence that the three chemicals cause or can reasonably be anticipated to cause adverse human health or environmental effects as specified under section 313 (d)." The data for EPA's decision was supplied in a petition submitted by the Dry Color Manufacturers Association (DCMA).

For further information, contact Maria J. Doa, Petitions Coordinator, Emergency Planning and Community Right-to-Know Hotline, (800) 535-0202.

Legislation

Please Note: Congress will be in recess from August 5 through September 9, 1991.

Notice

Obtaining Congressional Documents

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

Senate

Senate bills, reports and public laws, and conference reports are available in the Senate Document Room, B-04 Hart Senate Office Building. The public may obtain as many as six different items per request, either in person or by mail. Requests for multiple copies of one item are not permitted. Only one request per person, per day will be filled. Mail orders may be sent to:

Senate Document Room
B-4 Hart Building
United States Senate
Washington, D.C. 20510

For information on the status and availability of legislative documents, the public may call the Senate Document room at (202) 224-7860. This is an information number only, and phone orders will not be accepted.

House

House bills, reports and public laws, and conference reports are available in the House Document Room, B-18 House Annex No. 2. As many as six different items per request may be obtained in person or by phone, and up to 12 items may be requested by mail. Multiple copies of one item are not permitted. One request per person, per day will be filled. Mail orders may be sent to:

House Document Room
B-18 House Annex No. 2
United States House of Representatives
Washington, D.C. 201515

For information on the status and availability of legislative documents, or to place a document order by phone, please call the House Document Room at (202) 225-3456.

House and Senate hearings and prints can be purchased at the Government Printing Office. For questions, information, and prices, call (202) 275-3030. Mail requests should be sent to:

Superintendent of Documents
Government Printing Office
Congressional Sales Office
Washington, D.C. 20402-9315

Occupational Safety and Health—On June 26, The U.S. House of Representatives passed an appropriations bill for the Occupational Safety and Health Administration (OSHA) that contains a provision expanding accident reporting requirements for employers.

The OSHA package, which is part of a spending bill for the Department of Labor, contains a number of riders that protect small businesses from "programmed" OSHA inspections. However, one of the provisions would increase the reporting burden on employers "for accidents involving hospitalization of injured workers." Current OSHA regulations require employers to report to the agency, within 48 hours, any accident that is fatal or results in the hospitalization of five or more workers. The new language in the appropriations bill amends that provision to require employers to report the hospitalization of one or more workers.

The Bush Administration opposes the accident reporting change as well as the riders that exempt from programmed inspections small businesses in industries with lower than average injury rates. Reportedly, both the Administration and the small business industry plan to try to block the accident reporting provisions when the bill is considered by the Senate Appropriations Committee.

SARA Title III—Senators Lautenberg (D-NJ) and Durenberger (R-MN) have released a draft proposal that would expand the chemical use reporting requirement under Title III of the Superfund Amendments and Reauthorization Act (SARA).

Under SARA, manufacturers are required to submit detailed "Form R" reports on chemical use. The draft, entitled "The Right to Know More Act," would increase the number and type of facilities that must submit reports, lower the chemical use reporting threshold, add to the list of chemicals for which reports must be submitted, and require hourly reporting of emissions to determine "peak releases."

At a June 26 hearing on the proposal, the EPA testified that because of budget restrictions, it might not be able to provide the necessary technical assistance to firms trying to decipher the myriad of new regulations. Industry groups are protesting the mandated peak release reporting, citing that data would be placed in an unrealistic reporting format because hourly reporting cannot adequately measure actual peaks.

The Senators have not determined when they will formally introduce the bill.

Waste Imports—Frustrated with the language in the Senate RCRA legislation, Sen. Dan Coats (D-IN), is threatening to attach his controversial waste import bill to a popular measure regarding the cleanup of Federal facilities.

Sen. George Mitchell's (D-ME) Federal facilities bill, S. 596, allows states to fine Federal agencies for violating environmental laws. The bill, which is awaiting floor action, has a tremendous amount of bi-partisan support and proponents feel that the Coats amendment would drastically decrease the chances for passage.

Sen. Coats' legislation (S.153) is controversial in that it "pits" East Coast states like New York and New Jersey that are at land fill capacity against Midwestern states that feel they are literally being dumped on by out-of-state waste. Sen. Coats is disappointed with the waste import language in the RCRA bill (S. 976) because it gives states only conditional control over imports of solid waste, and with the mandated time frame to comply, the provision would not take effect until 1996. Sen. Coats also maintains that if the state of Indiana keeps accepting waste from other states, its own landfills will be overflowing long before 1996.

The Senators from New York and New Jersey have engaged Sen. Coats in a year-long battle over this provision, arguing that an immediate ban would throw their states into a tailspin by forcing them to open up closed, substandard landfills. They have asked for more time to implement their solid waste management plans, noting that rapid progress is already being made in that almost every household in the tri-state area is a "veritable recycling center."

The Federal facilities legislation is scheduled for floor action before the August recess.

Biocides/Pesticides—Sen. Patrick Leahy (D-VT), Chairman of the Committee on Agriculture, has introduced legislation that would crack the "circle of poison" in which pesticides that are banned in the United States are sold to other countries only to return to the U.S. on crops sold to consumers. A companion bill sponsored by Rep. Mike Synar (D-OK) has been introduced in the House.

Under the current Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), pesticides that are used in the U.S. must be registered with the EPA. EPA approves the use of a pesticide only if a determination is made that the pesticide does not cause any adverse effects to human health or the environment. However, there is no regulation for pesticides that are exported to other countries.

The Circle of Poison Prevention Act (S. 898 and H.R. 2083) provides that all pesticide exports would be banned unless the pesticide has been registered in the U.S. Pesticides that have been registered for restricted use could only be exported to countries which have given prior consent to the importation of the substance. Additionally, the labeling on the package would have to be in the language of the country where the pesticide is being used.

Hearings on the issue were held in June, but no further action has been scheduled.

States Proposed Legislation and Regulations

California

Hazardous Waste—CA A. 604 (Kelley) exempts hazardous waste from the permit and variance fees, the waste assessment fees, and the generator surcharge fee. Exempts from the facility fee a facility used solely to manage hazardous waste resulting when a local government agency or its contractor investigates, removes, or remedies a release. Specifies that the provision allowing hazardous waste fees to be imposed on local agencies does not apply to this exempted hazardous waste or exempted facilities.

CA A. 1899 (Frizzelle) revises the conditions under which used or spent etchants, stripping solutions, and plating solutions recyclable materials to be regulated as hazardous waste, thereby imposing a state-mandated local program by creating a new crime. Requires the Department of Health Services to include in the biannual report the additions or deletions to the listing of recyclable hazardous wastes.

CA A. 2178 (Brulte) defines the term recyclable latex paint and generally prohibits any person from disposing of latex paint, unless authorized. Allows recyclable latex paint to be accepted at any location if specified requirements are met concerning the management of that paint. Exempts a person transporting recyclable latex paint from the manifest and hazardous waste hauler requirements, but requires the transporter to use a specified bill of lading.

Air Quality—CA A. 2060 (Polanco) requires state agencies and air pollution districts to adopt rules and regulations to grant variances and to adopt a variance process whereby an individual or private entity may apply for relief from regulations adopted by that governmental agency. Imposes a state-mandated local program by including air pollution districts in the requirements.

CA S. 546 (Presley) requires the South Coast Air Quality Management District to establish economic incentive programs to comply with the Federal Clean Air Act. Defines a substitute roll call for purposes of voting on items on the district agenda.

Household Hazardous Waste—CA A. 2092 (Sher) extends the dates when the source reduction and recycling element is required to be prepared and adopted to July 1, 1992, in the case of a city element, and January 1, 1992, in the case of a county element. Extends the date when the city and the county household hazardous waste element is required to be prepared to January 1, 1992. Specifies related duties if the city or county determines it is unable to comply with the deadline and requirements of the Act.

Delaware

Transportation—DE H. 179 (Ennis, B.) adopts Federal regulation regarding the transportation of hazardous materials in Delaware. Includes requirements governing the maintenance, use, inspection, repair, retest, and requalification of cargo tanks used to transport hazardous materials.

Packaging and Labeling—DE H. 294 (Mack) prohibits the sale of packaging materials in which certain heavy metals have been intentionally introduced during the manufacturing or distribution of the packaging; also prohibits the sale of products packaged in such materials; requires the Department of Natural Resources and Environmental Control to review the effectiveness of these prohibitions and to consider recommending the prohibition of other toxic substances contained in packaging; and aims at reducing the toxicity of waste disposal.

Illinois

Hazardous Waste—IL S. 924 (Welch) creates the offense of Criminal Operation of a hazardous waste or PCB incinerator and makes it a Class 4 felony.

Household Hazardous Waste—IL H. 114 (Novak) creates the Local Hazardous Waste Collection Program Act; requires the EPA to formulate a pilot plan for the collection of small quantities of hazardous waste from households, farmers, and businesses in the state by March 1, 1992; and requires the establishment of a statewide plan by March 1994.

Louisiana

Lead—LA S. 505 (Brinkhaus) relates to lead-based paint abatement and provides a prescriptive period for actions involving lead-based paint abatement in and adjacent to residences and residential buildings, school classrooms, auditoriums, gymnasiums, and other school buildings.

Massachusetts

Lead—MA H. 5630 (Committee on Health Care) prevents lead poisoning through increased lead paint abatement.

Art Materials—MA H. 1752 (Gibson, et al.) relative to toxic art or craft materials.

Nevada

Hazardous and Materials Transportation—NV S. 462 (Jacobsen) relates to hazardous materials; creates the State Emergency Response Commission; authorizes the Commission to adopt a schedule of fees for its services and regulatory activities and for persons who store or manufacture extremely hazardous materials for transport; and provides a penalty.

NV S. 572 (Senate Committee on Natural Resources) relates to hazardous materials and directs the Department of Motor Vehicles and Public Safety to adopt regulations governing the carrying of a permit to transport certain hazardous materials.

New Jersey

Solid Waste—NJ A. 1825 (McEnroe and Shinn) authorizes any county, municipality or authority to enter into a written cooperative agreement for the cooperative marketing of the recyclable materials designated in a district recycling plan required pursuant to the "New Jersey Statewide Mandatory Source Separation and Recycling Act."

Hazardous Substances—NJ S. 2220 (Dalton) establishes a regulatory program in the Department of Environmental Protection designed to prevent pollution through the reduction in the use and discharge of hazardous substances. Establishes as a statewide goal a 50% reduction over five years in the use of hazardous substances, in the discharge of hazardous substances into the air and water, and in the generation of hazardous waste. Requires owners and operators of certain facilities to inventory the substances that they use or discharge.

Lead—New Jersey Assembly Resolution 190 (Gill, et al.) memorializes the President, Congress, and the EPA to require lead content labeling for lead-containing products.

New York

Solid Waste—NY A. 2039 (Harenberg, et al.) imposes a ban on the use of multi-material containers to reduce solid waste.

Aerosols—NY S. 2369 (Padavan, et al.) 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.

Texas

Household Hazardous Waste—TX H. 1581 (Jackson) relates to the inclusion of a household hazardous waste collection program in a local regional solid waste management plan.

Vermont

Hazardous Waste—VT H. 39 (O'Brien) proposes to provide that waste oil, and discarded paint, paint thinner, and paint remover, and their respective containers, shall not be considered hazardous waste for purposes of their being transported. Prohibits landfilling of paint, paint thinners, paint remover, and their respective containers.

Gloss of Paint Films and the Mechanism Of Pigment Involvement

Juergen H. Braun
Du Pont Chemicals*

The optics and the perceptions of gloss are discussed in terms of *intensity-of-reflected-image* and *distinctness-of-image* and an hypothesis is proposed for the mechanism by which pigment degrades the gloss of paint films.

Paint films dry in two stages, separated by what we call a Surface Critical Point. During the first, wetter stage of drying, surface tension dominates and forces the surface of the wet film to remain smooth down to molecular scale. As the film dries, structure develops within. During the second, drier stage, the compressive strength of structure within the drying paint film—its yield stress—exceeds the surface tension, and as the film shrinks, its surface develops the micro roughness that diminishes gloss. The structure within the film is controlled largely, but not exclusively, by flocculation and packing of pigment particles.

The proposed mechanism is supported by paint lore and experimental results in optics, rheology, colloid science, paint practice, and pigment technology.

INTRODUCTION

Every American youngster dreams of owning a bright and shiny car. Because of pigments in the coating, the car will not be as bright and shiny as its dream version. The paint industry associates "shiny" with gloss, a quality of specularly (mirror-like) reflected light.

The gloss of paint films is a troublesome and costly issue to manufacturers of pigments, paints, automobiles, and appliances. Particularly on cars, customers like higher gloss than paints can deliver.

Pigment affects gloss of paint films in two ways. With increasing pigment concentration, the *intensity-of-image* component of gloss increases because the refractive index of the paint film increases; and the *distinctness-of-image* component of gloss decreases because the film surface becomes rougher. The refractive index effect has been explained but not the cause of surface roughness.

A hypothesis has been proposed for the mechanism by which pigment diminishes the gloss of paint films. Paint films dry in two stages, separated by what we call a Surface Critical Point. During the first, wetter stage of drying, surface tension dominates and forces the surface of the wet film to remain smooth down to molecular scale. As the film dries, structure develops within. During the second, drier stage, the compressive strength of structure within the drying paint film—its yield stress—exceeds the surface tension, and as the film shrinks, its surface develops the micro roughness that diminishes gloss. The structure within the film is controlled largely, but not exclusively, by flocculation and packing of pigment particles.

Observations and experimental evidence have been accumulated from exceedingly diverse spheres: optics, rheology, colloid science, paint practice, and pigment

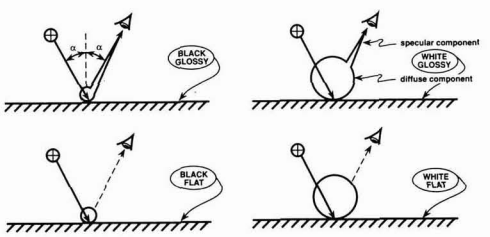


Figure 1—Intensities of reflected light

Presented at the 68th Annual Meeting of the Federation of Societies for Coatings Technology, in Washington, D.C., on October 30, 1990.
*R & D Div., Wilmington, DE 19898.

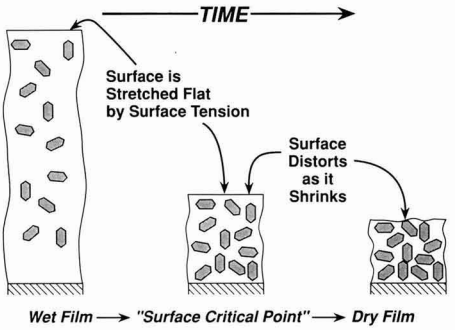


Figure 2—Wet paint film as it dries and shrinks

technology. Rather than organize the paper around sundry and crosslinked experimental detail, we decided to serve the interests of the casual rather than academic reader. Accordingly, the thesis is stated, argued briefly, and appended with supporting data and references. We hope that our academic readers will forgive this departure from convention in the interest of clarity. They will find conclusions cross-referenced to appended substantiations.

OPTICS AND PERCEPTIONS

Gloss is an appearance quality of specularly (mirror-like) reflected light. Just like color, gloss has distinct and separate psychological, physiological, and physical dimensions.[1]

Optically, gloss is a geometric attribute of the reflection of light by surfaces. Every surface reflects some diffuse light in all directions and some specular light at an angle equal to the angle of incidence. Black surfaces reflect very little diffuse light, white surfaces much light. Flat surfaces reflect very little specular light, glossy surfaces much specular light (*Figure* 1). Human perception of gloss appears to involve the distinctness of the reflected image rather than its intensity.[1]

The conventional glossmeter[2] measures the intensity of specularly reflected light. The distinctness of the reflected image is disregarded. The human eye, by contrast, is very sensitive to distinctness-of-image and rather insensitive to intensity-of-image. The glossmeter resolves or rather blurs image with an acceptance aperture of 2°, the distinctness-of-image meter resolves to 0.3°, and the human eye to 0.0005° of arc.

The intensity of specularly reflected light depends on the angle of observation and on two characteristics of the reflecting surface, its refractive index and its roughness[3]:

$$\frac{I_r}{I_i} = f\left\{\begin{array}{c|c|c}\text{angle of} \\ \text{observation}\end{array}\right.\left.\begin{array}{c|}\text{refractive} \\ \text{index}\end{array}\right|\left.\begin{array}{c}\text{surface} \\ \text{roughness}\end{array}\right\} \quad (1)$$

Where:

I_r = intensity of reflected light
I_i = intensity of incident light

The effects of all three variables are quantitatively defined by accepted optical theory (*Appendix* I).

The optical requirement for a satisfactory mirror image is resolution to the standards of the human eye. It is primarily an imaging device. In the mirror we expect to see small detail clearly, for example, every eyelash mirrored distinctly. A simple experiment reveals the limit of resolution of the human eye to be about 0.0005° of arc.*

Such resolution of reflected image, the "wet look,"† is achieved only by the surfaces of real and solidified liquids, smooth to molecular scale: all true** liquids—mercury, water, and coffee, but not tea††; solidified, amorphous polymers—glass, acrylic but not polyethylene***; and replicas of liquid or amorphous polymer surfaces—mirrors. Crystalline surfaces can approach the wet look only by crystal cleavage or through appropriate polishing.††† The wet look is more obvious on a dark background (coffee) than on light or transparent surfaces (water) because the brain behind the eye is distracted by features visible below the surface.

The two operational definitions of gloss, one based on human perception of distinctness-of-image and the other based on instrumental measurement of intensity-of-image, correlate well enough for most purposes of paint characterization and control.

PIGMENT CONTRIBUTIONS

Pigments contribute to surface roughness and to refractive index of paint films. As a result, TiO_2 pigment affects gloss in two opposing ways. With increasing TiO_2 concentration:

the *intensity-of-image* component of gloss increases because the pigment raises the refractive index of the paint film (*Appendix* I-C);

the *distinctness-of-image* component of gloss decreases because particulates roughen the film surface (*Appendix* I-D).

The refractive index effect has been explained by theory and confirmed by experiment (*Appendix* I-B, C, D). Not previously explained was the specific cause of surface roughening of paint films and the mechanism of pigment involvement.

Table 1—Test Paints

Three paints were used in most experiments, typical test paints developed for and used extensively in the evaluation of TiO_2 pigments

Paint A	Waterborne White		
	Shrinkage: 75 vol%,	Solids: 38 wt%,	PVC: 27 vol%;
Paint B	Waterborne White Interior Acrylic Emulsion Paint		
	Shrinkage: 66 vol%,	Solids: 51 wt%,	PVC: 23 vol%;
Paint C	Solvent Thinned White Truck Finish		
	Shrinkage: 54 vol%,	Solids: 66 wt%,	PVC: 19 vol%.

*A human hair with a measured diameter of 50 μm was just visible at a distance of 19 ft: arcsin [50/ (19 × 12 × 25 × 1000)] = 0.00050°C

†In nature, mirror reflection from surfaces other than water is quite rare. That is why rescue mirrors can signal the presence of humans.

**Single phase liquids, excluding concentrated emulsions and concentrated slurries.

††Hot tea (without lemon or milk) develops a solid film of tannic acids on its surface as it cools.

***Polyethylene is crystalline.

†††Nighttime skin lotions have an oil (liquid) base and make the face look shiny. Day lotions have a base of (crystalline) wax to avoid a sweaty look.

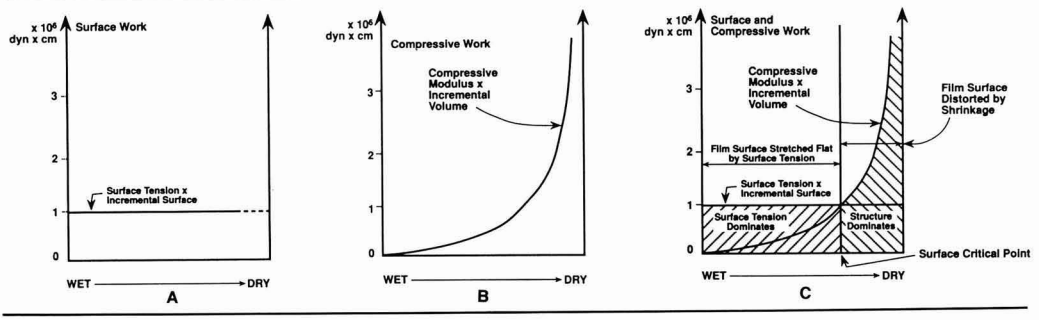


Figure 3—Drying paint film

Proposed Mechanism

Postulated below is a cause-and-effect relationship between particle interaction and gloss, seen as interplay between surface tension and skinning,* that is, compressive strength from structure developing within the wet paint film as it dries and shrinks:

(1) While a paint film dries, its volume shrinks from evaporation† by 30 to 80% depending on the paint formula (*Figure* 2) (*Table* 1).

(2) During this shrinkage, the surface of the wet film skins over, structure develops at the surface and within the film from contributions of pigment, extender, and resin particles. While the film dries, the structure strengthens (*Figure* 3A). Structure results from chemical and mechanical interaction between particles. In flocculated systems, structure develops earlier in the drying sequence than in well dispersed paints. In emulsion systems, structure develops earlier than in solutions. Ultimately, structure can become locked by direct contact between particles.

(3) In response to structure, the yield stress of a drying paint film increases from essentially zero for paint itself to about 10^{10} dyne/cm^2 for a fully dried paint film.

(4) Surface tension of most paints ranges from 30 to 50 dyne/cm and should remain fairly constant during drying (*Figure* 3B).

(5) During the initial phase of drying, surface tension of the liquid maintains its smooth surface, down to molecular scale.

(6) When the growing compressive modulus of the film exceeds the surface tension, its ability to maintain optical smoothness is lost. A Surface Critical Point** can be defined (*Figure* 3C) where the work of compressing the internal structure (or submerging a wetted pigment particle) exceeds the work expended to create additional surface (for a projecting, wetted particle):

$$\text{Surface Work} = \text{Compressive Work} \quad (2)$$

$$\text{Surface Tension} \times \text{Incremental Surface} = \text{Yield Stress} \times \text{Incremental Volume} \quad (3)$$

and, by cancellation of terms (*Figure* 4):

$$\text{Surface Tension} \times 4 = \text{Yield Stress} \times \text{Critical Diameter} \quad (4)$$

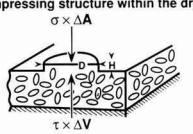
The geometry factor "four" applies to protruding cylinders. Protrusions of other geometries have only slightly different factors.

On the "wet" side of the Surface Critical Point, surface tension dominates and the surface stays smooth. On the "dry" side of the Surface Critical Point, structure dominates and surface smoothness can deteriorate.

Because solvents diffuse slowly, structure does not develop uniformly through the thickness of the film but diminishes from the surface into the bulk, the surface solidifies before the bulk, the film skins.

(7) On the dry side of the Surface Critical Point, the film continues to shrink, but it is no longer kept smooth by surface tension. Smoothness now degrades to roughness because micro regions of the film shrink unevenly.

At the "Surface Critical Point" the work required to create incremental surface equals the work of compressing structure within the drying paint film.



Compressive Work	=	Surface Work	I
Yield Stress x Incremental Volume	=	Surface Tension x Incremental Surface	II
$\tau_0 \times \Delta V$	=	$\sigma \times \Delta A$	III
		σ = 20 to 70 dyn/cm (Water: 73, Xylene: 30)	
		D = @ 1 x 10^{-4}cm	
τ_0	=	30 x 4/1 x 10^{-4}	IV
τ_0 at SCP	=	@ 1 x 10^6 dyn/cm^2	V

NOTE: Effects are somewhat dependent on geometry: (Cylinder, Prism, Spherical Segment, etc.)

Figure 4—Surface Critical Point

*Like paint skins in an open can. The effect is most pronounced at the surface and diminished with distance into the bulk.

†Water, solvent, or condensation products for waterborne, solventborne, and high-solids paints, respectively.

**Actually a critical range rather than a point.

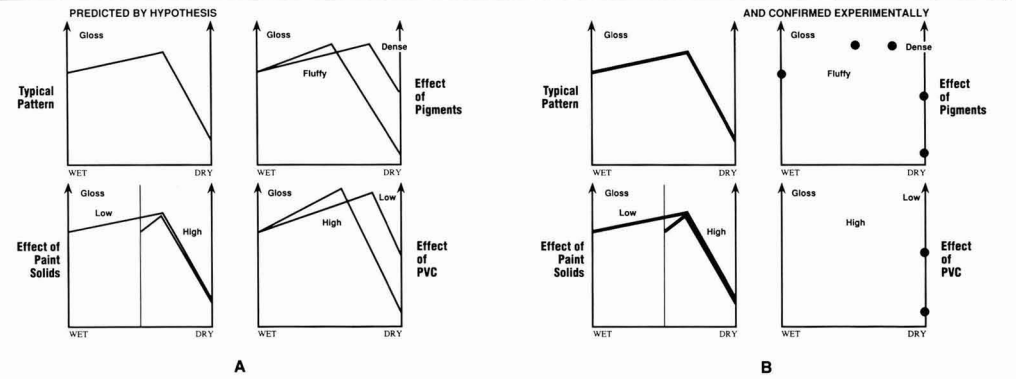


Figure 5—Gloss patterns. A—predicted by hypothesis; B—confirmed experimentally

(8) The distinctness-of-image gloss of an optically smooth surface is "perfect," that is, a function only of its refractive index; whereas, the surfaces of typical white paint films are rough and have a less than perfect gloss. Structures about 0.05 μm high degrade gloss severely (*Appendix* I-D).

(9) Pigments that differ in their flocking and packing characteristics differ also in the composition that corresponds to the Surface Critical Point. Loosely flocked pigments develop structure earlier during drying and shrink more in the domain of structure control than densely flocking or packing pigments (*Appendix* II-A).

The proposed mechanism explains many observations, accounts for the results of numerous gloss and model experiments, and predicts performance, confirmed by measurements.

DISCUSSION

The study changed our perspective of gloss. We conclude that gloss of paint films has two independent components:

(1) A distinctness-of-image component diminished by surface roughness (*Appendix* I-D and II-D-1),

Every liquid surface is smooth down to molecular scale and reflects images at perfect distinctness,

Paint films of very low pigment volume concentration (PVC) resemble liquids and approach perfect distinctness-of-image gloss.

(2) An intensity-of-image component controlled by refractive index (*Appendix* I-C).

White paint films of moderate to high pigment volume concentration have a low distinctness-

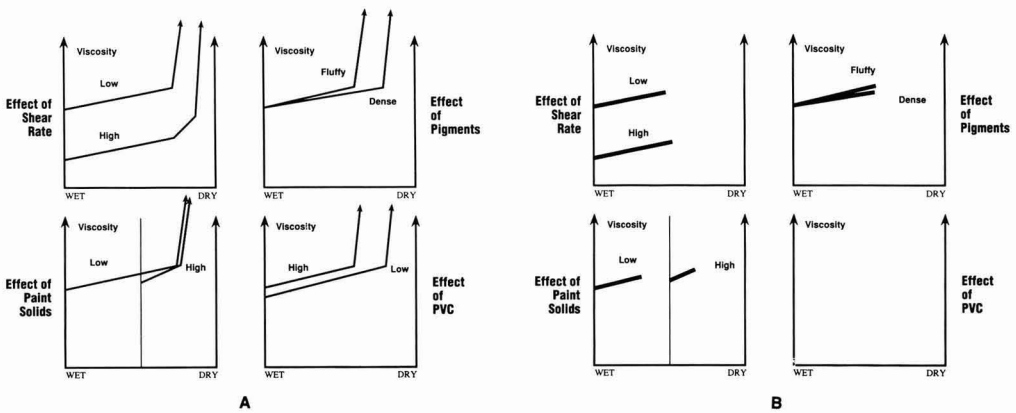


Figure 6—Rheology patterns. A—predicted by hypothesis; B—confirmed experimentally

of-image and a moderately high intensity-of-image;

Conventional gloss meters measure the intensity component of gloss; and

Human perception of gloss readings is biased towards the distinctness-of-image component because the eye responds more effectively to contrast than to intensity.

Diverse experimental results and observations of gloss manifestations are consistent with the proposed mechanism for the degradation of gloss by pigment:

Pigment packing correlates with gloss—the fluffier the pigment, the lower its gloss (*Appendix* II-A-1).

The more flocculated a system, the lower its gloss (*Appendix* II-D-2).

Packing considerations based on TiO_2 filter cake packing and on model experiments agree quantitatively (*Appendix* II-A-2).

Results of optical calculations fit into the mechanism (*Appendix* I).

The mechanism explains the effects on gloss of PVC, substrate porosity, associative thickeners, flatting agents, and surface tension (*Appendix* II-D-2,3).

Effects of film thickness and drying conditions become obvious if one considers the concentration gradients that develop from the skin into the bulk of a drying paint film (*Appendix* II-D-2,4).

The hypothesis led to predictions about gloss and rheology patterns during drying of paint films. The predictions were confirmed experimentally.

A comparison of predicted and measured gloss patterns is given in *Figures* 5A and B (*Appendix* II-B).

Features of the typical pattern were predicted correctly,

The effects of pigment packing characteristics were predicted and confirmed,

Effect of paint solids and PVC of the formula were predicted. A few points were measured and confirm predictions.

Predicted and observed rheologies are compared in *Figures* 6A and B. Viscosities could be measured only during the early stages of drying (*Appendix* II-C):

Viscosities were predictably lower at high shear rate,

Some effects that paint solids content have on gloss were predicted and confirmed.

ACKNOWLEDGMENTS

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APPENDIX I: OPTICS

A. Polarization

Reflection causes linear polarization of light.[4] Because the human eye cannot sense polarization, we ignore it in gloss matters. In effect, we sum parallel and normally polarized intensities.

B. Angle of Reflection

The intensity of reflected light increases with the refractive index of the reflecting surface and with the angle* of reflection. The combined effects of angle and refractive index are given by equation (5)[4]:

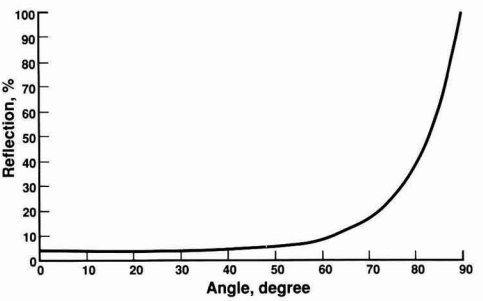

Figure 7—Specular reflection vs angle of incidence. n = 1.5. Calculated from equation (4)

*The angle of reflection is conventionally measured from the normal to the reflecting surface: angle of retro reflection equals 0°; and angle of grazing reflection equals 90°.

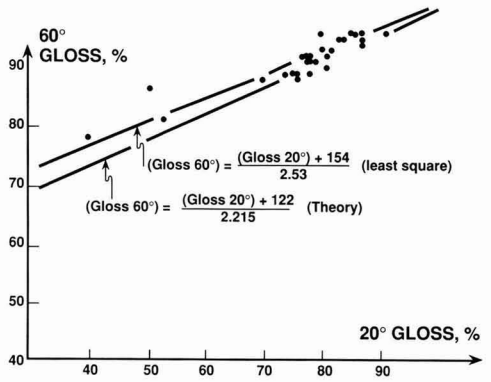

Figure 8—60° vs 20° gloss

$$\frac{I_r}{I_i} = \tfrac{1}{2} \times (K^2 + L^2) \qquad (5)$$

Where:
I_r = intensity of reflected light
I_i = intensity of incident light

With:

$$K = \frac{\cos\phi - (n^2 - \sin^2\phi)^{0.5}}{\cos\phi + (n^2 - \sin^2\phi)^{0.5}}$$

$$L = \frac{n^2 \times \cos\phi - (n^2 - \sin^2\phi)^{0.5}}{n^2 \times \cos\phi + (n^2 - \sin^2\phi)^{0.5}}$$

Where:
ϕ = angle of incidence and reflection
n = refractive index of surface vs air.

Figure 7 illustrates the effect of angle of observation, the angle of incidence and reflection, on intensity of light reflected by a surface of the refractive index of organic polymer. Data were calculated from the expanded Fresnel Equation [equation (5)].

Agreement between optical theory and paint practice is illustrated in *Figure* 8 by a comparison of experimental 60° and 20° gloss measurements on a set of panels. The experimental data points were summarized into a "least square" equation and are compared with results of calculations based on "theory." The empirical and the theoretical lines track each other and the equations agree well.

C. Refractive Index

Refractive index effects are described by equation (5). For 0° reflection, the equation takes the familiar form of the Fresnel Equation:

$$\frac{I_r}{I_i} = \left(\frac{n-1}{n+1}\right)^2 \qquad (6)$$

Where:
n = refractive index of surface vs air.

At 90°, reflection becomes total and refractive index effects disappear.

Any film composed of binder and pigment particles too small to be visible to light has a refractive index intermediate between the indices of pigment and of binder.[5] Because the difference between the two is large—pigment very high, binder moderate—the effect is substantial. If pigment particles are large enough to scatter light (and that is certainly true for TiO_2 pigment), the composite concept applies, but not quantitatively. Thus, the refractive index of a TiO_2 pigmented paint film is significantly larger than the refractive index of the binder alone.

The increase of refractive index with pigment concentration is detectable as a gloss increase when a wet paint film begins to dry. *Figure* 9 shows our data for a typical paint film drying under the glossmeter.

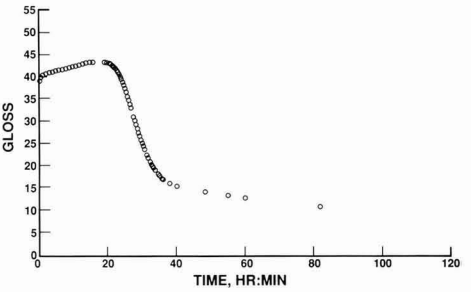

Figure 9—20° gloss vs drying time for Test Paint A

D. Surface Roughness

High gloss requires very smooth surfaces. Roughness diminishes gloss by diffraction mechanisms. Very small vertical displacements thus have large effects on reflected intensities. The effects of surface roughness on gloss are given by equation (7).[3-6]

$$\text{Actual Gloss} = \frac{I_r}{I_i} \times e^{-\left(\frac{4 \times \pi \times \sigma \times \cos\phi}{\lambda}\right)^2} \qquad (7)$$

Where:
σ = measure of roughness
λ = wavelength of light.

An estimate of the effects of refractive index, roughness, and angles of incidence and reflection on the relative intensity of specular reflection by paint films is given in *Figure* 10, based on calculations using equations (5-7). Illustrated are the effects of four sizes of roughness: 0.005, 0.01, 0.02, and 0.05 μm. Plotted is the relative decrease of reflectance versus the angle of incidence and observation.

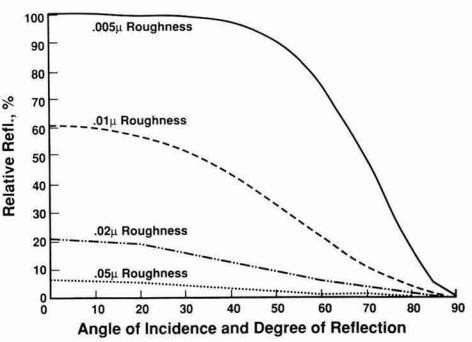

Figure 10—Gloss decrease caused by roughness

APPENDIX II: EXPERIMENTAL RESULTS

We did many more and different experiments than space permits us to describe in customary detail. Accordingly, we report only those experimental parameters that are directly relevant to the outcome.

A. Pigment Packing

1. Oil Absorption:

Oil Absorption (OA) is a measure of pigment packing, but a poor one, affected by oil/pigment interactions and afflicted with a vague end point. We used OA for correlations with gloss only because OA data are familiar to the industry.

The correlation of gloss (20° gloss, Test Paint C) with OA for Du Pont Ti-Pure® (Du Pont Chemicals) grades is striking (*Figure* 11)[7]:

$$\text{Test Paint C Gloss (20°)} = 102 - 2.1 \times \text{OA} \qquad (8)$$

Other data correlate gloss (60° gloss, Test Paint B) with OA by:

$$\text{Test Paint B Gloss (60°)} = 116 - 3.5 \times \text{OA} \qquad (9)$$

2. Packing Model:

The proposed gloss mechanism involves structure within the paint film with particle packing as the predominant contributor. For insights models were constructed.

Without breakage, pigment particle models do not pack as densely as real pigment packs in a typical paint film. In two experiments, we tossed individual model particles and assemblies of them into a box. Individual particles did pack tight enough to attain the volume concentration of our typical paint (Test Paint A, 27% PVC). However, an identical number of primary particles glued together into assemblies of four overflowed the box at much less than 27 vol% packing.

TiO_2 filter cakes can also be considered a model of pigment packing. Filter cakes are packed beds of interlocking pigment particles, somewhat like the densest possible packing one could visualize to occur in a drying paint film (*Figure* 2).

Most TiO_2 filter cakes contain 14 to 20 vol% TiO_2, dependent on pigment grade. Usually, the primary pigment particles are flocked into assemblies. Deflocculated particles would pack more densely. This considered, the packing densities of typical TiO_2 filter cakes agree with the postulated gloss/packing relationship.

B. Gloss of Drying Paint Films

Gloss was measured during drying by placing a vented glossmeter directly onto a fresh, wet paint film. Measurements were taken at timed intervals until the paint film was superficially dry by evaporation of water, with much of the glycol coalescing aids still in the film. A typical result is shown in *Figure* 9. Gloss increases linearly to a maximum, then drops steeply, at first linearly, and eventually levels towards a final value. Studies of the drying of paints[8] and of clay slurries[9] show that for colloidal systems the rate of drying is constant at first and eventually decreases to zero.

The distinct pattern of gloss change during drying repeated itself in all the experiments: for high and low gloss pigments (*Figure* 12), with Test Paint A (*Figure* 12) and Test Paint B (*Figure* 13), and even for Ti-Pure R-940 pigment slurry without resin (*Figure* 14).

Results of numerous gloss/drying experiments are summarized in *Figure* 5B for comparison with predictions (*Figure* 5A) made by examining the consequences of pigment packing parameters in the light of the hypothesis that this paper advances.

Attempts to standardize the rate of drying of the paint film under the instrument did not succeed. Quantitative comparisons between individual experiments are thus not appropriate.

To estimate film composition at the Surface Critical Point from gloss/drying data, we tried to substitute weight measurements for drying time, but could not simultaneously weigh the film and measure the gloss. Instead, we rated visually the change in gloss while panels dried on the balance. The gloss break, the abrupt change from high distinctness-of-image to no-image, occurred at a film composition that corresponds to a Surface Critical Point in the range of 12 to 18 vol% pigment in the drying paint film. Data are shown in *Table* 2 together with results of graphic evaluations of gloss/time plots.

C. Rheology of Drying Paint Films

During drying, structure develops within the paint film. The interplay of the compressive strength of this structure with surface tension sets the stage for the degradation of gloss and connects rheology of drying paints with gloss of ensuing films. At the Surface Critical Point, compressive work equals surface work.

For insight, we attempted to measure compressive work in terms of yield stress, but were constrained instrumentally. Rheology measurements were performed on samples of partially dried and scraped paint films using a Rotovisco in cup and bob configuration.

Viscosities of drying Test Paint A and Test Paint B decreased with shear rate and increased with drying and solids content. Viscosities of the paints were higher for the paints with higher pigment concentration (Test Paint B) than for lower concentration paints (Test Paint A). Typical data are shown in *Figure* 15. No clear pattern was apparent for high and low gloss paints.

Yield stresses of drying paint films were found to increase from a range of 10 to 30 dyne/cm^2 for Test Paint B and Test Paint A to the range of 100 to 400 dyne/cm^2 for drying to about 60% solids (*Figure* 16 and 17). Rheology could not be measured at the Surface Critical Point and during the latter stages of drying.

Results of all rheology experiments are summarized in *Figure* 6B for comparison with predictions (*Figure* 6A) based on the gloss hypothesis of this paper.

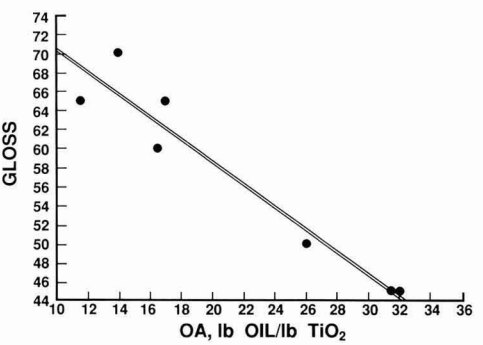

Figure 11—20° gloss vs oil absorption, Du Pont Ti-Pure grades, for Test Paint C

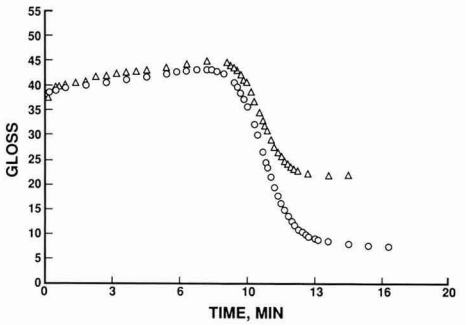

Figure 12—20° gloss vs drying time for Test Paint A. Δ—High gloss pigment, O—low gloss pigment

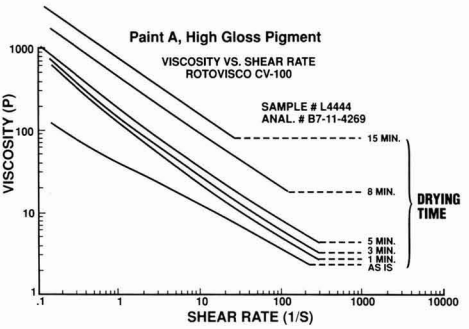

Figure 15—Typical viscosity pattern

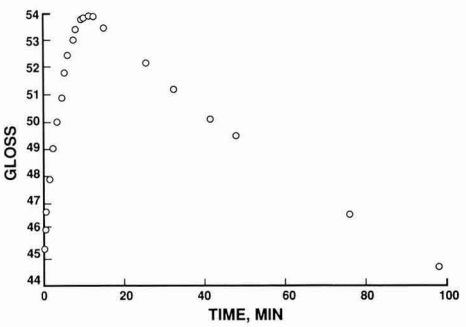

Figure 13—20° gloss vs drying time for Test Paint B

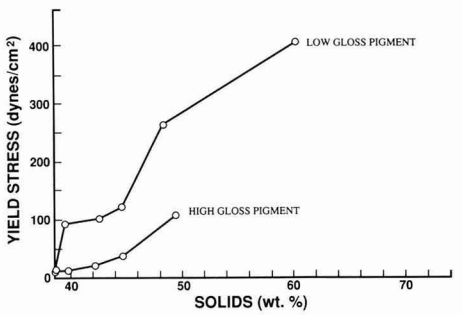

Figure 16—Yield stress vs wet film solids for Test Paint A

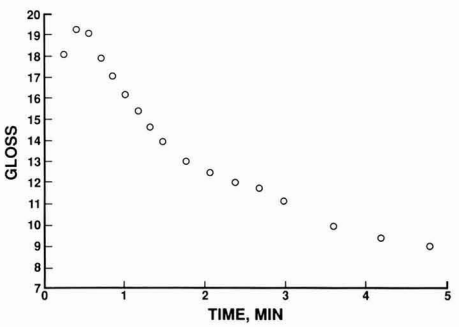

Figure 14—20° gloss vs drying time for R-940 slurry

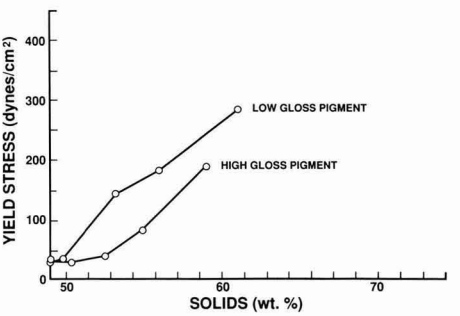

Figure 17—Yield stress vs wet film solids for Test Paint B

Table 2—Estimates of Pigment Concentration in the Drying Paint Film at the Surface Critical Point (SCP)

Estimate Based on	Paint	Pigment	Volume Concentration of Pigment at the SCP, %[a]
Gloss/time experiments	A	R-900	22
	A	R-960	19
Gloss/weight experiments	A	R-960	18
	B	R-902	12
	B	R-900	15

(a) Formulation PVC of Paint A: 27%; Paint B: 23%.

D. Miscellaneous Observations

1. Surface Smoothness:

Lack of surface smoothness has been established by both theory and practice as cause of low gloss. A quantitative relationship has been derived between gloss and dimension of defects.[3,6,10] Several experiments were conducted with metallized paint films to confirm that gloss is an effect of surface topology without contributions from within the paint film. A film of vacuum deposited palladium prevents penetration of light into the paint film. Yet metallized high and low gloss paint films had the relative gloss performance of the original films. Surface replicas of paint films were prepared. They too showed the relative gloss performance of the originals.[10]

In yet another model experiment, we could show that dimensions of surface features correlate with dimensions of subsurface structure. Experiments were performed with Jello as a model of a structured liquid, and with sands in it of various sizes as models of particulates. The Jello was liquid and, after it had set, the surfaces had the "wet look" of very high distinctness-of-image. This glossy surface showed bumps and depressions, the dimensions of which correlated with the size of the sands that ranged in size from 14, 60, 100 to 150 mesh.

2. Gloss Tests:

All gloss manifestations have elements familiar to most paint technologists, considered to hold true for most paint systems:

Gloss decreases with PVC. The decrease with PVC is initially slight, but becomes substantial near the critical pigment volume concentration (CPVC). Above the CPVC, gloss increases again.

Gloss of a paint is decreased severely if the paint is applied over a porous substrate.

Flocculation of the pigment decreases gloss.

Thickeners and jelling agents act as flatteners, reducing gloss.

Gloss increases with film thickness.

Drying conditions affect gloss.

3. Effect of Surfactants:

Surfactant with a pronounced effect on surface tension decreased gloss by an average of three units. Dispersant that did not lower the surface tension did not affect gloss. Tested in a statistical design were eight Test Paints B made from three Ti-Pure R-900 pigments and one Ti-Pure R-940 slurry using 0.04% "Zonyl" FSB amphoteric fluoro surfactant as the most surface active material available. In accordance with its function for the evaluation of TiO_2 pigments, Test Paint B is formulated to be minimally susceptible to flocculation.

Our results do not contradict the fact that surfactants can improve gloss. That happens for paints where flocculation has diminished gloss and surfactants deflocculate the pigment.

4. Effect of Drying Rate:

Effects of drying rate on gloss were studied to illustrate skinning, i.e., the contributions to performance of the vertical concentration gradients that can develop within the paint films.

Waterborne paint films were dried at three sets of conditions: "slowly" in high humidity and at ambient temperature; "conventionally" in 30% relative humidity and at ambient temperature; and "rapidly" with forced, hot air. Eighteen experiments were conducted with Test Paint B using three Ti-Pure R-900 pigments and one Ti-Pure R-940 slurry. Average glosses of the dried films were: slowly—71; conventionally—69; and rapidly—64. At a standard deviation for the test of about ± 1, the differences are significant.

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Analytical Studies of Light Stabilizers In Two-Coat Automotive Finishes

H. Böhnke, L. Avar†, and E. Hess†
Sandoz*

Light stabilizers are known for protecting two-coat automotive finishes from the harmful effects of weathering. Such systems are stabilized with UV absorbers in combination with radical scavengers of the HALS type. However, the light stabilizer content in an enamel is reduced during weathering, resulting in negative consequences for light stabilization.

Using the microtome section technique, two-coat automotive finishes were completely removed, layer by layer, in 2 μm sections, which were then analyzed for their UV absorber content. In this manner, exact UV absorber content profiles through the entire coating could be established which permitted important conclusions as to the behavior of the UV absorbers during baking and weathering.

These analytical studies were carried out for different classes of UV absorbers, and various types of two-coat automotive finishes. Analogous examinations were also performed for HALS stabilizers.

INTRODUCTION

For some time now, light stabilizers (LS) have been used to prevent or retard photodegradation processes in two-coat automotive finishes.[1] UV absorbers (UVA) are preferred for this purpose, combined with radical scavengers of the hindered amine light stabilizers (HALS) type. Although the stabilizing effects of both these LS have been thoroughly investigated,[2–4] there is still a lack of necessary information concerning the behavior of such compounds (migrations, permanence, etc.) in these finishes.

In recent years, various studies have been published which established a correlation between the residual UVA content and weathering test results.[2,3,5] However, the analytical methods used provide only very approximate and incomplete information. Thus, although reflectance measurements are easy to carry out on finishes exposed to weathering,[6] strictly speaking, they do not permit any conclusions as to the residual UVA content of the finish. A quantitative evaluation of reflectance data can therefore quickly lead to false conclusions. Moreover, UVA weathering losses up to ca. 30% are practically undetectable by this method.[7]

On the other hand, chromatographic methods, such as those described in the literature,[2,5] provide quantitative information on the UVA content. However, neither reflectance measurements nor the chromatographic techniques described up to now permit statements concerning the UVA content as a function of the coating depth.

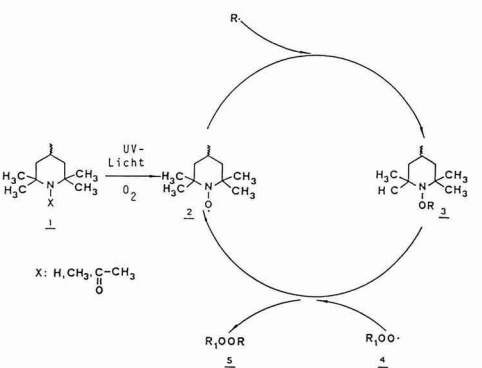

Figure 1—Stabilization mechanism of HALS compounds

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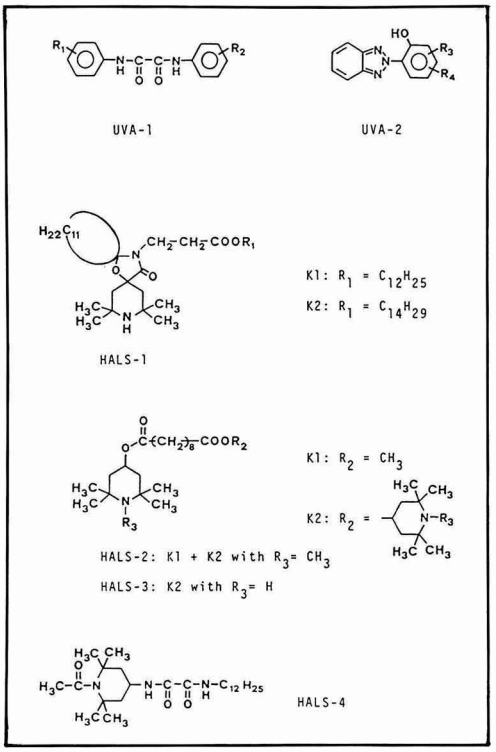

Figure 2—Structures of UVA-1, UVA-2, HALS-1, HALS-2, HALS-3, and HALS-4

However, since the effectiveness of UVA depends on this depth, it is naturally very interesting to know the precise concentration profile of the UVA through the entire coating.

At present, little detailed information has been made available concerning the behavior of HALS compounds in two-coat automotive finishes, although numerous studies are found in the literature[8] which deal with the mechanistic aspects of HALS compounds. However, the precise mechanism of action of HALS compounds is still not completely understood. Nevertheless, it is generally accepted that the stabilizing effect does not proceed from the HALS compound **1** but from the nitroxyl radical compound **2** (*Figure* 1). The **2** is formed from **1** by oxidation during weathering, and then reacts with radicals R·, which also form during weathering, to the amino ether **3**. The nitroxyl radical is regenerated by reaction with peroxide radicals **4**. Therefore, in general, by means of **2**, a harmful radical R· is converted into a stable compound **5**. However, since the nitroxyl radical **2** does not exhibit unlimited stability to weathering, the losses must be offset by the renewed formation of **2** from **1**. For this reason, it is important to know the weathering behavior of the HALS compounds used in the finish.

A detailed study of the behavior of both LS classes in two-coat automotive finishes for different examples has been made. The UV absorbers used were the oxalanilide UVA-1 and the benzotriazole UVA-2 (*Figure* 2). HALS-1 and -2 were investigated as radical scavengers. Both are liquid products and both consist of two components. The behavior of a neutral HALS-4 also was investigated. Neutral HALS products are acylated at the piperidine nitrogen atom [compound **1** with $X = C(O)CH_3$]. As amides, these compounds exhibit no further basic properties and, therefore, are suitable especially for the stabilization of acid-cured enamels.

Using a microtome, entire two-coat automotive finishes (unexposed and exposed) were removed, from the surface, in 2 μm sections. The sections were then analyzed for their LS content via HPLC or GC. In this manner, exact LS concentration profiles through the entire two-coat finish were obtained.

EXPERIMENTAL

To be able to make precise 2 μm sections with a microtome, a special coating application was necessary. The two-coat finishes were applied directly to aluminum foil without a primer (*Figure* 3). A two-coat finish of a ca. 50 μm total thickness, therefore, provides a maximum of 25 sections. The first layers consist of pure clearcoat (CC) material. The proportion of basecoat (BC)

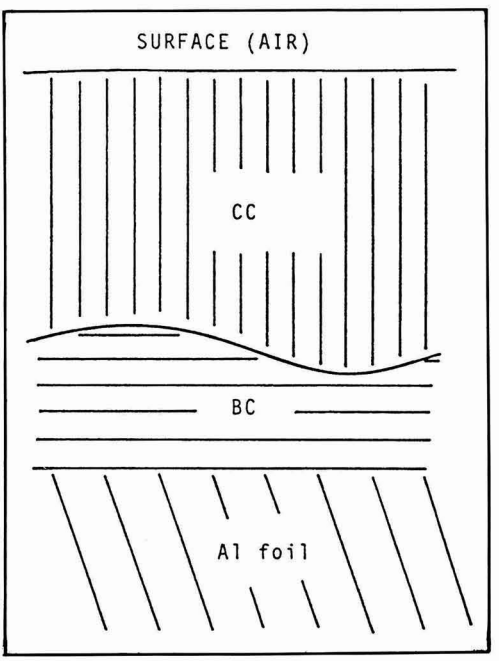

Figure 3—Two-coat finish for microtome experiments

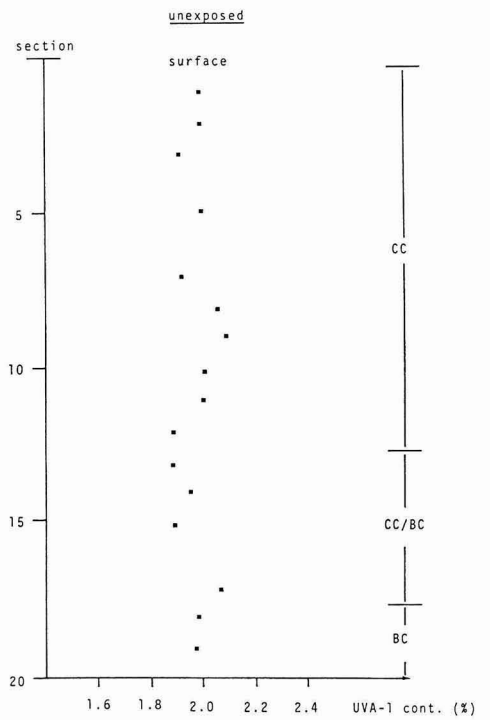

Figure 4—UVA-1 content as a function of coating depth. Initial weight (into CC): 2.9% UVA-1; CC: TSA-LS (35 μm); BC: PES-CAB/blue (15 μm)

material in the sections then increases until pure BC sections are obtained at the end.

The microtome sections were then extracted in an ultrasonic bath. After removal of the solid components, the solutions were then subjected to HPLC (for UVA) and GC analysis (for HALS). (For experimental details, see reference 7).

RESULTS AND DISCUSSION

UV Absorber

Figure 4 shows the UVA-1 concentration profile determined in this manner for a solvent-containing coating system [baking conditions: 30 min at 140°C (wet-on-wet application)]. Here, the UVA-1 content is plotted as a function of the coating depth (section number). The allocation of the sections for the CC, CC/BC, and BC layers was made in each case based on a visual assessment of the material.

With a finish of this type, a virtually homogenous distribution of the UVA-1 is observed over both coats (CC and BC) after baking, even though the LS was added to the CC only. During baking, therefore, the UVA-1 diffuses from the CC into the BC until homogenous distribution is attained. Accordingly, the UVA-1 content in the CC is lower than the weighed amount.

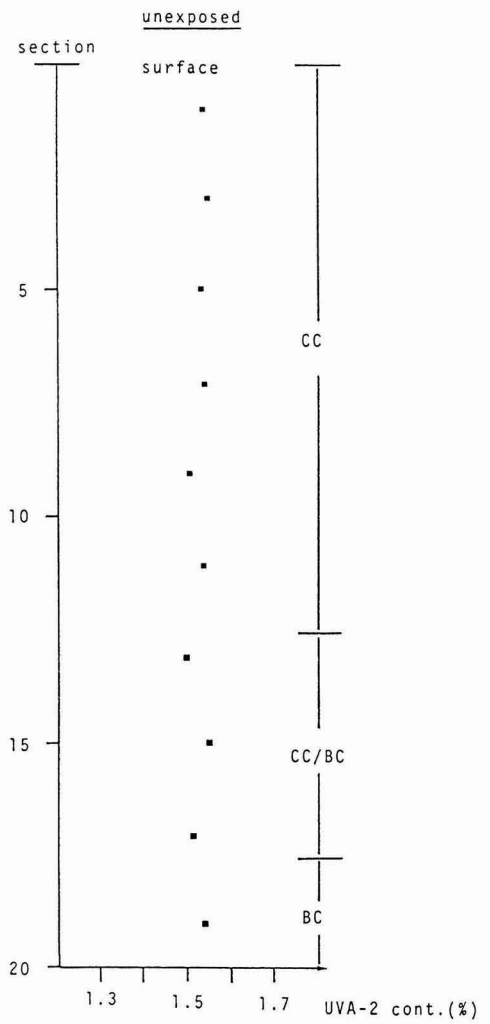

Figure 5—UVA-2 content as a function of coating depth. Initial weight (into CC): 2.5% UVA-2; CC: TSA-LS; BC: PES-CAB/blue

Since the surface and density are approximately the same for CC and BC, the coating thickness ratio directly provides the mass ratio of the CC and the BC. In the system described in *Figure* 4, the CC is about twice as thick as the BC. Therefore, with a homogenous distribution of the UVA-1, the content in the entire finish must be about one-third less than the weighed amount calculated on the CC. With an experimentally measured value of 1.9%, UVA-1 corresponds to the mean content to be expected based on this estimate. The lower UVA-1 con-

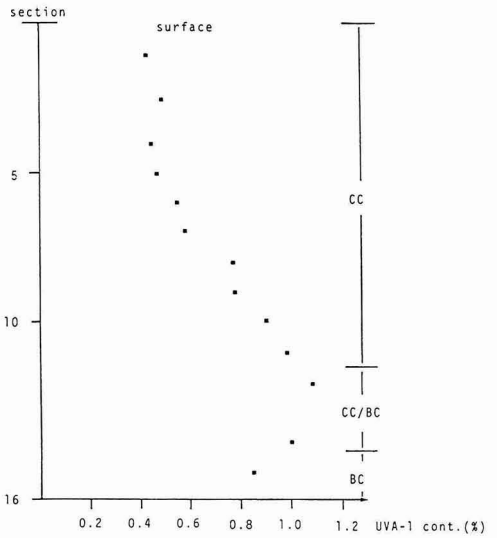

Figure 6—UVA-1 content as a function of coating depth; after 12 months Florida exposure (5° s/black box). Initial weight (into CC): see *Figure* 4; CC: TSA-LS; BC: PES-CAB/blue

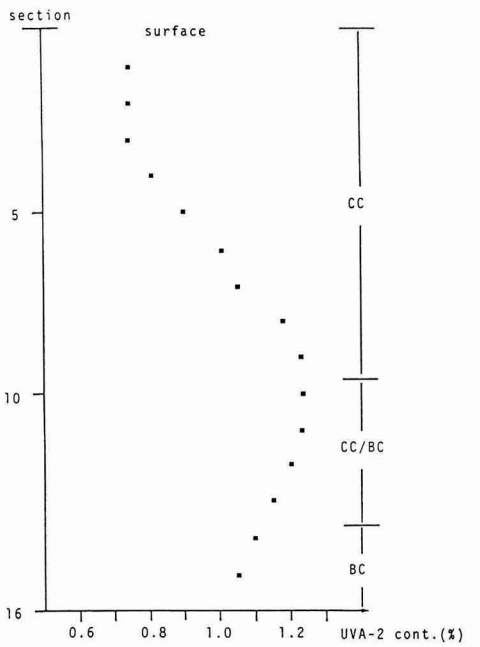

Figure 7—UVA-2 content as a function of coating depth; after 12 months Florida exposure (5° s/black box). Initial weight (into CC): see *Figure* 5; CC: TSA-LS; BC: PES-CAB/blue

Table 1—Content of HALS-1 and -2 in One-Coat Finishes (1C-TSA-LS)

Stabilizer	I.W.[a]	Content (%) After Bak.[b]	After DO[c]	After CC[d]
HALS-1	2.2	2.2 (100)	2.2 (100)	2.1 (95)
HALS-2	2.2	1.6 (73)[e]	1.2[f] (55)	1.3 (59)
HALS-4	3.0	3.0 (100)	3.0 (100)	2.9 (97)

(a) Initial weight rel. to binder solid.
(b) Baking (30 min, 140°C).
(c) Drying oven (1000 hr at 40°C).
(d) Climate chamber (1000 hr at 40°C and 100% humidity).
(e) Values in brackets show the content (%) rel. to the initial weight.
(f) Formation of a white film on the finish.

tent, as compared with the weighed amount found in the CC, therefore, results solely from diffusion phenomena which occurred during baking.

When the benzotriazole UVA-2 is used, an analogous homogenous concentration profile is observed for the unexposed system (*Figure* 5). Like the UVA-1, the UVA-2 diffuses into the BC during baking. The UVA-2 content in the CC is accordingly lower.

In *Figures* 6 and 7, the relationships between the UVA-1 and UVA-2 after 12 months of weathering in Florida are shown. Instead of a homogenous distribution, a dependence of the UVA content on the coat depth is now seen in both cases. However, the effects are similar for both UVA. In the upper CC region, the UVA content is constant and then gradually rises, while the concentration again drops off approaching the BC.

The automotive finish used in these examples consisted of a conventional solvent-containing CC and BC. A change to a coating with a water-based BC and a solvent-based CC has a decisive influence on the UVA content profile. In a water-based system, a dependence of the UVA content on the coating depth (*Figures* 8 and 9) is already observed in unexposed test specimens. In both cases, the UVA concentration in the CC is constant and then falls sharply in the boundary layer between the CC and the BC. In the BC, the UVA content is again constant, but distinctly lower than in the CC. With water-based two-coat systems, therefore, only a small amount of UVA diffuses into the BC during baking. In a discussion of the cause of this phenomenon, thermodynamic and kinetic points must be taken into account.

After 12 months' Florida exposure, the content profiles change. Similar effects were observed with both UVA

Table 2—Blooming Behavior of HALS-1 and -2 in Different Clearcoats

Clearcoat	Blooming HALS-1	HALS-2
1C-TSA-LA	no	yes
1C-TSA-MS	no	yes
2C-PUR	no	yes
2C-PUR-MS	no	yes

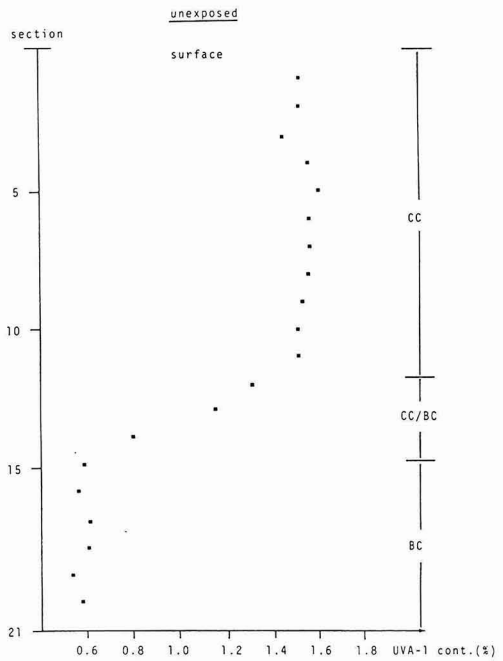

Figure 8—UVA-1 content as a function of coating depth. Initial weight (into CC): 2.5% UVA-1; CC: 2C-PUR-HS; BC: water-based, opaque

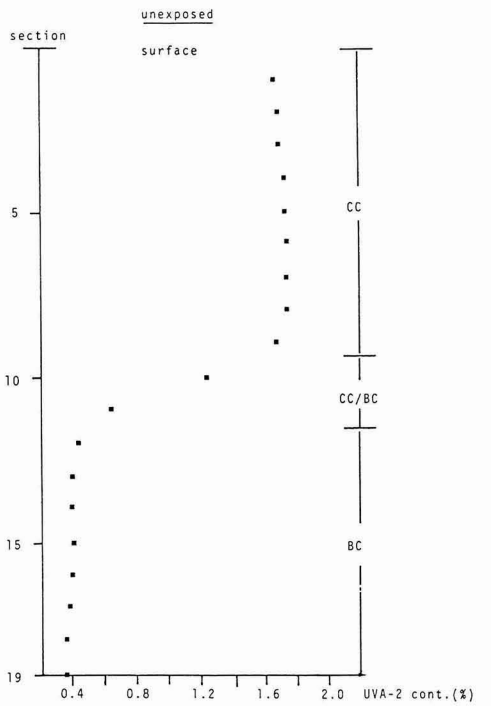

Figure 9—UVA-2 content as a function of coating depth. Initial weight (into CC): 2.5% UVA-2; CC: 2C-PUR-HS; BC: water-based, opaque

investigated (*Figures* 10 and 11). From the surface, the UVA content increases and reaches its maximum value in the lower CC region. In the CC/BC boundary layer, the UVA concentration drops considerably and is again constant in the BC. The UVA content in the BC is practically unchanged, as compared to the unexposed system. During exposure, therefore, no (undesired) UVA concentration equalization takes place between the lower CC region and the BC.

As these studies show, UVA of the oxalanilide and the benzotriazole type exhibit very similar behavior in the two-coat finishes investigated. The content profiles obtained for the UVA-1 and UVA-2 resemble each other very strongly. (In all examples discussed previously, the specimens also contained 1% HALS-1). The decisive influence on the UVA concentration profile and, therefore, on the stabilization results, is exercised by the type of the two-coat finish.

HALS

As mentioned earlier, UVA in combination with radical scavengers of the HALS type are used for the stabilization of these finishes. However, unlike the case with the UVA, little is still known about points such as baking losses, thermostability, and washing-out effects of HALS compounds in coatings.

In order to determine the total HALS content in coatings, the test material was extracted in an ultrasonic bath in the same way as the UVA. The extraction solutions obtained were analyzed by GC.

A satisfactory gas chromatography analysis can only be made of such compounds that are not chemically bound (incorporated) to the finish during baking. This condition is not always met by HALS compounds. Many systems such as HALS-1 (*Figure* 2) have an NH function, which makes their binding to the finish possible in principle. With HALS-2 and HALS-4, the corresponding amine functions are substituted. For this reason, the chemical incorporation of both HALS compounds in the finish is not possible.

Table 1 gives the behavior of HALS-1 and -2 in the presence of heat and moisture. In order to rule out possible concentration variations due to migration of the HALS stabilizers between the different layers of the coating, these tests were carried out on one-coat CC systems.

After baking, the weighed amount of HALS-1 is found to be completely intact (see *Table* 1). This system is, therefore, not incorporated into the finish. Baking losses do not occur with HALS-1. The low volatility of this stabilizer is confirmed by the drying oven test. HALS-1 exhibits excellent permanence even in a special climate chamber. After 1000 hr, virtually no losses were observed. Washing-out effects, which would reduce the content, are accordingly not a factor with HALS-1.

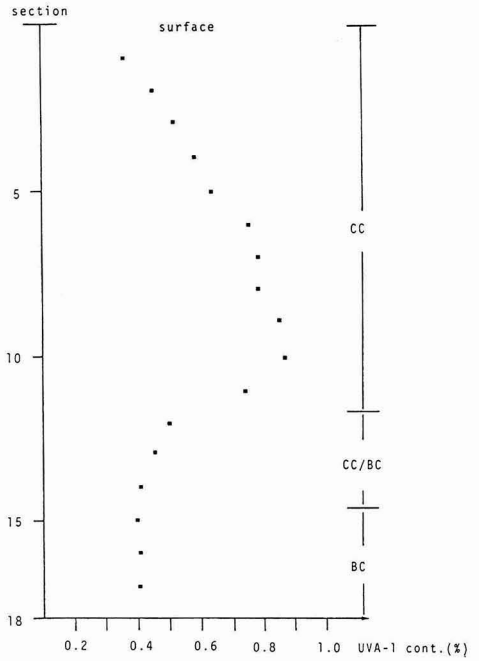

Figure 10—UVA-1 content as a function of coating depth; after 12 months Florida exposure (5° s/black box). Initial weight (into CC): see *Figure* 8; CC: 2C-PUR-HS; BC: water-based, opaque

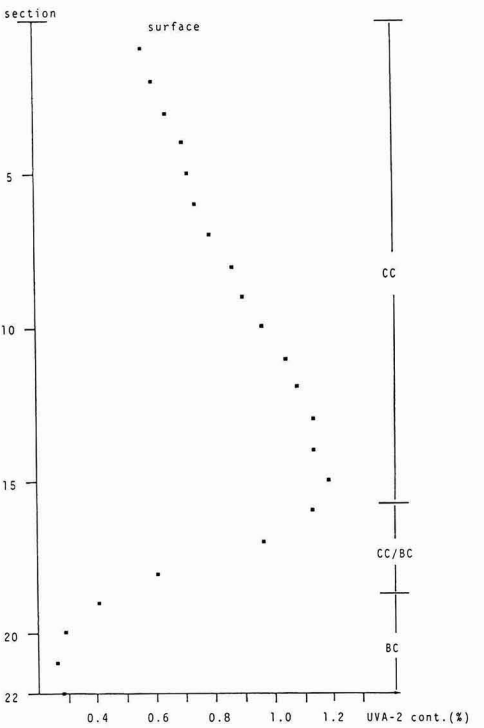

Figure 11—UVA-2 content as a function of coating depth; after 12 months Florida exposure (5° s/black box). Initial weight (into CC): see *Figure* 9; CC: 2C-PUR-HS; BC: PES-CAB/blue

With the HALS-2, after baking the content is 1.6%, or only 73% of the original weighed amount. Since this system has no reactive group, the losses cannot be explained by incorporation effects. The observed losses are therefore definitely the result of the high volatility of HALS-2. This finding agrees with the data in the literature.[9]

During storage in the drying oven, a white deposit formed on the HALS-2 specimen. The HALS-2 concentration in the finish was only 1.2%. After 1000 hr in the climatic chamber, the HALS-2 concentration was 1.3%, that is, of the same order of magnitude as after the corresponding drying oven test.

An analogous series of tests also was carried out for the neutral HALS-4. In a similar manner to stabilizer HALS-1, HALS-4 shows very good behavior in the finishes. HALS-4 exhibits virtually no volatility and is not washed out even in the climatic chamber. Both in the case of HALS-1 and HALS-4, unlike HALS-2, no undesired loss of stabilizer was observed.

It has already been mentioned that a white deposit was seen to form on the HALS-2 specimen during the drying oven test. This finding is all the more remarkable as HALS-2 is a liquid product. Up to now, undesirable blooming phenomena of this type have only been found with sparingly soluble stabilizers such as certain benzotriazoles.[10]

From *Table* 2, it can be seen that this blooming of HALS-2 occurs in a variety of different CC finishes. The formation of the white deposit was observed already, in many cases, after 100 hr at 40°C. At room temperature, this time is correspondingly longer. No case of blooming was observed for HALS-1.

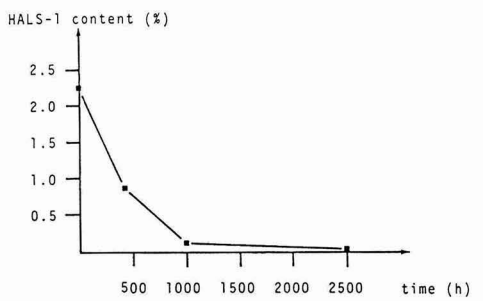

Figure 12—HALS-1 content as a function of UVCON exposure time [HALS-1 content of a one-coat finish (CC: TSA-LS)]

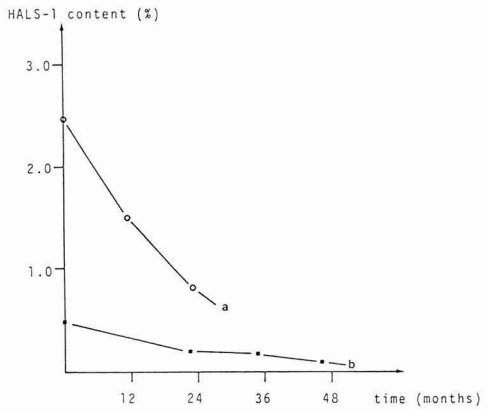

Figure 13—HALS-1 content (%) as a function of Florida exposure time [HALS-1 content of the CC of a two-coat automotive finish (CC: TSA-LS, BC: PES-CAB)]

As expected, during exposure to weathering, the HALS concentration in the finish changes very rapidly (*Figure* 12). Under these conditions, the sterically hindered amine is converted into the nitroxyl radical (compare with *Figure* 1). Already, after 1000 hr of UVCON weathering, the HALS-1 content is only 0.1%. Within this time, the HALS-1 concentration sinks to only ca. 5% of the original weighed amount.

During the Florida exposure, the HALS-1 content decreases appreciably more slowly (*Figure* 13). Even after 48 months' Florida weathering, HALS-1 can still be clearly detected in the CC of a two-coat metallic finish (curve b). A comparison of curves a and b seems to indicate that the presence of a UVA has no decisive influence on the relative decrease of HALS-1.

With N-methylated HALS compounds, such as HALS-2, the relations during weathering are not so clearly observable. According to literature,[8] with these compounds the nitroxyl radicals may be formed directly from the HALS compound. On the other hand, it is also known[11] that the methyl group is split off in the presence of UV light, whereupon the corresponding unsubstituted NH-HALS product is formed. In agreement with these findings, HALS-3 has been definitely detected in weathered CC finishes containing HALS-2 (*Figure* 2). According to recent studies,[12] the rate of formation of the nitroxyl radical is the same for NH and N-methyl HALS compounds.

These gas chromatography studies have made it possible to give a quantitative description of the behavior of HALS stabilizers in clearcoats. However, these studies have provided no information on the behavior of HALS compounds as a function of the coating depth.

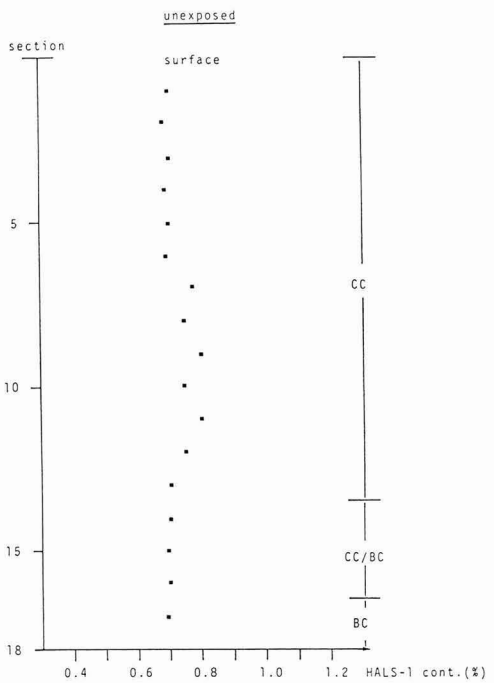

Figure 14—HALS-1 content as a function of coating depth. Initial weight (into CC): 1.0% HALS-1 (and 2.3% UVA); CC: TSA-LS; BC: PES-CAB/blue

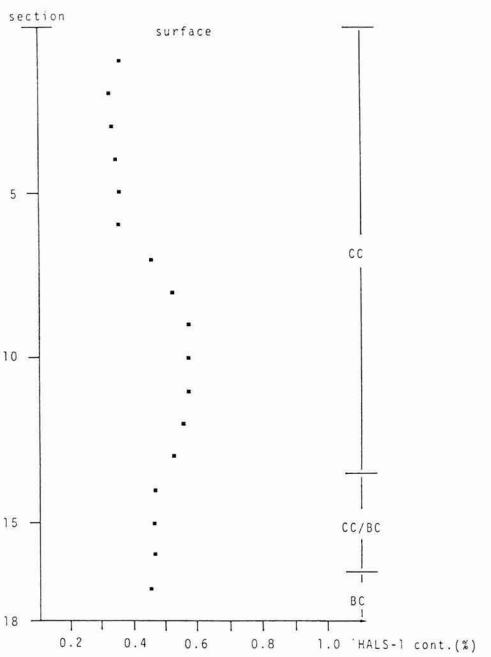

Figure 15—HALS-1 content as a function of coating depth. Initial weight: see *Figure* 14; CC: TSA-LS; BC: PES-CAB/blue

Gas chromatography studies of the microtome sections of two-coat finishes have now provided exact HALS concentration profiles. In an analogous manner to the UVA, after wet-on-wet application (baking conditions: 30 min at 140°C), the HALS-1 stabilizer, in a conventional pure solvent system, exhibits a homogenous distribution through the entire coating, even though the stabilizer was added to the CC only (*Figure* 14). During the baking, the HALS stabilizer diffuses into the BC until homogenous distribution is attained. Accordingly, the HALS-1 content of the CC is also lower than the weighed amount.

After 1600 hr accelerated weathering, the profile changes (*Figure* 15). The HALS-1 concentration is now a function of coat depth, although this concentration dependence is not so strongly pronounced as with the UVA. The HALS content is constant in the upper part of the CC, then slowly increases, and reaches its heaviest concentration in the CC/BC boundary layer. In the BC, the HALS-1 content is just slightly higher than in the CC. Since, as we have seen, washing-out effects are of virtually no consequence with HALS-1, this increase may be due to the formation of the corresponding nitroxyl radical. However, the correlation of this finding with weathering results is not a simple matter, due to the complex mechanism of action of HALS stabilizers.

CONCLUSIONS

In comparing the different results, it can be seen that the method of weathering has a decisive influence on the HALS content. Whereas HALS-1 is virtually totally converted after 1000 hr of weathering in the UVCON (*Figure* 12), after 1600 hr of the Atlas WOM test, about 70% of the original HALS-1 amount can still be detected (*Figure* 15). During one-year Florida exposure, the HALS-1 content decreases by only ca. 30% (*Figure* 13).

Since, as mentioned previously, HALS-1 is inert to thermal losses and washing-out effects (see *Table* 1), the observed decreases in concentration may primarily be due to the conversion of the HALS-1 into the corresponding nitroxyl radical. However, this means that in regard to the HALS stabilizers, different relations must exist in the three types of weathering, where the Atlas WOM (Xenon lamp) test clearly seems to come nearer to the Florida weathering than the UVCON (fluorescent tube, UV-B, 313 nm) method.

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* * * *

REVIEW PAPER

Selection of Weatherable Coatings For Thermoplastic Olefins

Rose A. Ryntz
Akzo Coatings, Inc.*

Consumption of automotive plastics in the United States continues to climb and is expected to double by 1999. It is estimated that the average weight of plastic use per automobile will be 300 pounds. This increased use of plastics, both in interior and exterior applications, also increases the importance of developing coatings for plastics.

This paper will disclose the types of coatings used in plastics. In particular, the surface treatments utilized and types of coatings applied to obtain weatherable, adhesive coatings to thermoplastic olefins will be discussed.

INTRODUCTION

Consumption of automotive plastics in the United States is expected to double in the next decade to a volume of 4.17 billion pounds by 1999.[1] The ten highest growth applications alone will account for an increased 744 million pounds per year of plastics by 1999. Applications such as pick-up bodies, gas tanks, and interior trim will utilize plastics such as thermoset polyester, polyphenylene sulfide (PPS), acrylonitrile-butadiene-styrene (ABS), and polypropylene (which are expected to be the plastics of highest use).[2] It is estimated that the average weight of plastic use per automobile will be 300 pounds compared to the 180 pounds used today.

The major advantages of choosing plastics as alternatives to metal substrates are numerous: performance and ease of manufacturing; cost effectiveness (see *Figure* 1) over metal alternatives due to energy consumption decrease due to decrease in weight, lower cost of tooling, especially for complex shapes and styling, and faster tooling time; inherent corrosion resistance properties of plastics; and styling latitude.

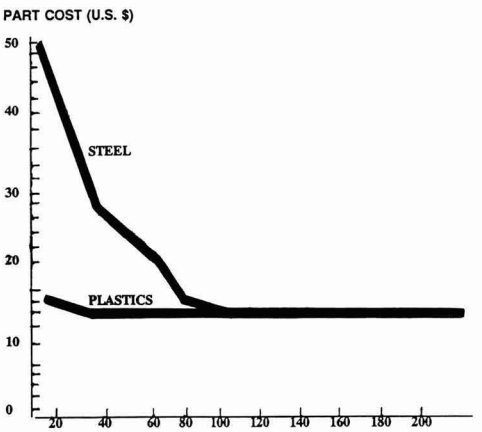

Figure 1—Volume/cost sensitivity, plastics vs steel

These advantages have led to the increased use of plastics for both interior and exterior automotive parts (*Tables* 1-3). This increased use of plastics leads to a corresponding increase in the importance of plastic coatings.

COATING TYPES FOR PLASTIC

With the advent of RULE 632 in December of 1988, Michigan set volatile organic content (VOC) emission limits for the painting of plastic parts for automobiles, trucks, and business machines. The rule will gradually tighten emission limits through 1990, 1991, and 1992.

Presented at the 68th Annual Meeting of the Federation of Societies for Coatings Technology, in Washington, D.C., on October 29, 1990.
*1845 Maxwell St., Troy, MI 48084.

Table 1—Common Interior Rigid Automotive Plastic Substrates

Plastic Substrate	Automotive Part	Coating Type
Sheet molding compound (SMC)	Engine covers, window garnish molding	High bake primer and topcoat
Acrylonitrile-butadiene-styrene (ABS)	Ashtrays, glove boxes, knobs, speaker grills, instrument panels, consoles, and gauges	Air dry topcoat

Table 2—Common Exterior Rigid Automotive Plastic Substrates

Plastic Substrate	Automotive Part	Coating Type
SMC, BMC	Grille opening panels, lids	High bake primer
Nylon	Cowl vent, grilles, and moldings wheelcovers	High bake primer and/or topcoat
Nylon, polybutylene terephalate (PBT)	Mirror housings	High bake primer
PBT	Door handles	High bake topcoat
ABS	Grilles, mirror housings	Air dry primer and/or topcoat
PBT/polyphenylene oxide (PPO) (Gemax)	Fenders/doors	Primer/topcoat
Nylon/PPO (Noryl GTX)	Fenders	Primer/topcoat
Polycarbonate (PC)/ABS (Pulse 930)	Fenders/doors	Primer/topcoat
PC	Lens bodies, lights	Air dry primer and/or topcoat
ABS	Wheel covers	Air dry topcoat

Table 3—Common Flexible Automotive Plastic Substrates

Plastic Substrate	Automotive Part	Coating Type
Thermoplastic olefin (TPO)	Airbags covers, lower valence panel bumpers, and dashboards	Primer and/or topcoat
Vinyl ABS alloy	Vinyl crash pad	Topcoat
TPO, thermoplastic urethanes (TPU), RIM	Bodyside claddings	Primed topcoat
RIM	Bumper covers, fascias, and window gasket moldings	Primer and/or topcoat
Polyurea/polyurethane (Bayflex)	Fender/fascia	Primer/topcoat
TPO, RIM	Endcaps, spats	Primer and topcoat
TPO, RIM	Sight shields	Primer and topcoat
PC/polyethylene terephthalate (PET) (Bexloy)	Bumpers/fascias	Primer/topcoat
PBT/polytetramethylene terephthalate (PTMT) (Lomod)	Fascias	Primer/topcoat
PBT/polytetrahydrofuran (PTHF) (Riteflex)	Fascias	Primer/topcoat

The proposed 1993 limits for coating plastic parts of automobiles and trucks will be either 3.0 or 3.5 lb of VOC per gallon of coating as applied, depending on the particular painting category. Both automotive/truck and plastics finishing will require an application transfer efficiency of at least 40%.

Not only are solvent emission limits being changed dramatically, requiring the use of high solids, low molecular weight resins to achieve the limits, but there are typically two types of coatings applied to automobiles: those that cover "flexible" substrates and those that cover "rigid" plastic substrates. In the past, chemistries of the coatings were varied so that a low glass transition polymer would be applied over the flexible substrates, allowing flexibility but compromising hardness and often durabilities, and a high glass transition polymer would be applied over rigid substrates, allowing for desired hardness but also encompassing a brittle nature.

Considerable research has since been conducted in an attempt to develop a new coating type which would provide the necessary flexibility and durability to be used over both flexible and rigid plastic substrates. As this transition occurred, the cure temperature of these coatings was also reduced to common bake cycles of approximately 250°F. However, to permit the use of many future engineering plastics with exceptionally low heat distortion temperatures (*ca.* 180°F-200°F), a new generation of low temperature curing coatings is being developed.

Not only are the optical effects (gloss, DOI, color) of coating types important, but the ability to improve the surface quality of many non-class A surface plastics by covering pores, flow lines, and other flaws is also of tantamount importance. Technical requirements such as chemical resistance and outdoor durability also play an important role. Very careful adaptation of the coating materials to the various substrates is imperative in order to gain good results with the composite material "coated plastic." Factors such as organic solvent attack during paint application, paint adhesion phenomenon, influence on mechanical characteristics, and the like may affect the properties profile of painted plastic parts.

The automobile industry is moving more toward a basecoat/clearcoat topcoating system to achieve "metallic glamour." They are moving away from the conventional monocoat topcoats of the past because of the difficulty in attaining the glamour in light metallics. *Figure* 2 pictorially depicts a coating system as applied to a plastic substrate. A conductive primer is applied to the plastic at a film build of 1.0-2.0 mils. Typical conductivities of the dry conductive primer film should be in the 140-165 Ransberg units range to allow for effective application of the topcoats. A primer surfacer, optionally applied at a film build of 0.8–1.5 mils, is used to provide additional leveling characteristics to the primer. A basecoat is then applied at a film thickness of 0.6-0.8 mils (1.0-1.2 mils straight shade) to supply the color to the coating system. A clearcoat, at a film thickness of 1.6-1.8 mils, is finally applied to provide durability and a distinct appearance to the total coating system.

In addition to obtaining high solids, low VOC in coatings by the use of low molecular weight, low viscosity polymers in solvent, waterborne coatings have also be-

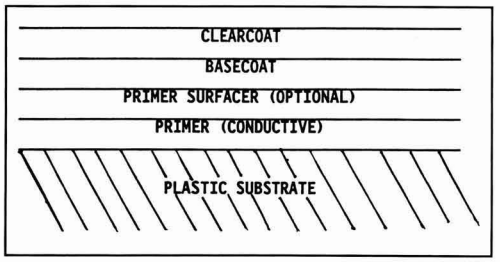

Figure 2—Typical coating system over plastic

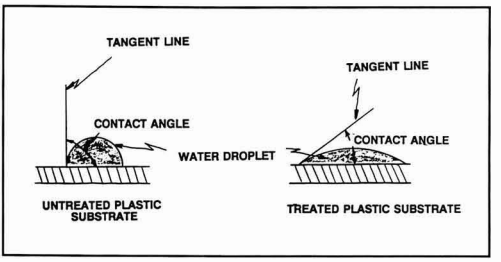

Figure 3—Relation of contact angle with wettability

come fashionable. The use of waterborne primers, however, necessitates a very clean, dirt- and grease-free plastic surface because of the poorer wetting characteristics of waterborne coatings versus solventborne coatings (which can "bite" into the plastic surface). Waterborne basecoats, while still remaining prone to poor wetting characteristics, are becoming the norm to achieve very high metallic glamour. Application parameters required to apply waterborne basecoats, however, are generally more strict in regard to temperature/humidity control than are solventborne coatings.

Coatings applied to plastic substrates vary according to the "class" they apply to. Those coatings applied to rigid automotive plastic substrates are generally similar to those applied to steel. Primers for rigid automotive plastics do not require excessive flexibility and/or durability because the plastic itself is not flexible. The primer is generally topcoated with the same topcoat used on the steel portion of the automobile.

The primer, however, does have to form a good adhesive bond to the plastic, often requiring additional stone-chip resistance. The balance of stone-chip resistance and adhesion can usually be obtained through the use of hard/soft-rubbery regions by utilizing acrylic/polyester blends. Adhesion promoters are often used to enhance both cohesive and adhesive properties of the coating.

Flexible coatings have generally been comprised of dicarboxylic acid esters crosslinked with monomeric melamines to produce coatings with high extensability/flexibility, toughness, elasticity, and adhesion.[3-5] The coatings lack good weathering resistance and often lack flexibility at low temperatures. Improved flexible coatings were introduced[6-8] that consisted of urethane extended polyester. The urethane extension improved weathering resistance somewhat and increased the low temperature flexibility of the coatings. The aforementioned systems lacked one important property, however, that being continued flexibility upon aging. In an attempt to maintain flexibility upon aging, chemistries were varied and crosslinkers were modified. Modified melamine crosslinkers containing styrene-allyl alcohol in combination with a polyester were formulated.[9] Several researchers attempted to prepare polyester-acrylics[10-13] for increased durability, appearance, and mar resistance. Polyurethane-acrylic blends[14,15] or polyester-acrylic-urethane copolymers[16] crosslinked with melamines or isocyanates appear to perform most satisfactorily as flexible coatings with regard to appearance and durability. The two-component (2K) urethane finishes are ideal for plastic substrates, because the crosslinked materials have better durability and will withstand more abrasive environments than will the melamine (1K) crosslinked systems.

ADHESION TO THERMOPLASTIC OLEFINS

The aforementioned coating types work well over most surfaces previously used in automotive applications. With the advent of thermoplastic olefins into automotive plastic applications, however, substrates are becoming increasingly difficult to paint because of lack of adhesion of the topcoat. One of the absolute criteria for maximum bond strength between materials, for example, paint and plastic substrate, is wettability. In surface wetting, even minute traces of contaminants on the order of angstroms will adversely affect the contact angle. The inherently low surface energy of polymers, such as the thermoplastic olefins [in particular polypropylene (PP)], also adversely affects adhesion. Therefore, most surfaces must be treated prior to application of a surface coating for the attainment of maximum adhesion.

In surface wettability, the effect of polarity is greater than that of the London dispersion forces. The energy of a single dispersion force bond is approximately 1 kcal/mole. On the other hand, a molecule physically absorbed to the surface at, for example, 50 segment sites, can be bonded via London forces with a total energy of about 50 kcal/mole. This total bond energy due to dispersion forces has the magnitude of a chemical bond.

In surface wetting, the effect of polarity outweighs that of the London forces; therefore, any interference on the surface of polarity by even a thin layer of nonpolar material will adversely affect wetting. Wettability, commonly defined by the contact angle between a drop of a liquid and the surface, is the characteristic most relevant to the

Table 4—Effect of Surface Treatment on Wetting of Polymer Surface Contact Angle (Degrees)

Polymer	Control	Plasma	Flame	Corona	Chemical
Polypropylene	87	22	87	35	60
Polyester	71	18	—	—	75
PVC	90	35	—	—	79
Polycarbonate	75	33	—	—	76
Polyethylene, HD	87	42	38	42	54

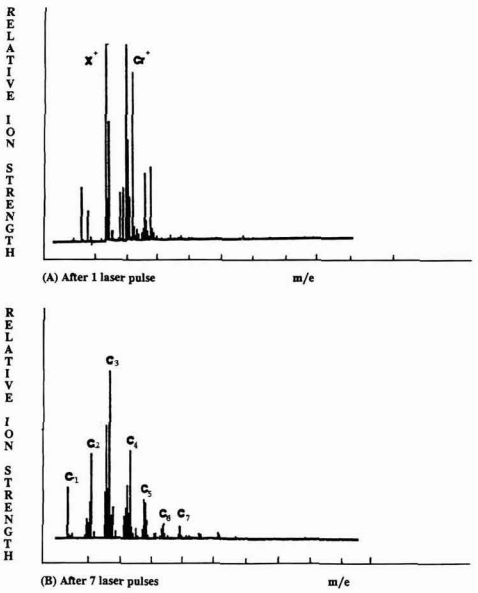

Figure 4—LMMS pattern for chemical pretreated polypropylene

adherence of paint (*Figure* 3). A line drawn tangent to the surface of the water droplet at the point of contact with the substrate surface defines the angle. The smaller contact angle is indicative of improved wettability.

POLYPROPYLENE PRETREATMENT

Polypropylene, both as a homopolymer, as well as blended with ethylene propylene dimeric mixture (EPDM), is an attractive plastic material, which combines a low raw material cost with excellent mechanical properties. Due to the apolarity of the surface, however, PP/EPDM mixtures are known as materials which are difficult to paint. Various methods have been developed to modify the polypropylene surface in order to obtain a substrate with better wettability adhesion so that standard plastic coatings materials can be applied. Flaming,[17-18] plasma discharge, benzophenone/UV,[19] corona discharge, or chromic sulfuric acid treatment (chemical)[20] can be used as methods to affect wettability of the polypropylene substrate. *Table* 4 lists the effect of various surface treatments on the wettability of a variety of surfaces. It can be seen in *Table* 4 that for polypropylene, the plasma treatment drastically reduces the surface tension of the water droplet from 87° (before treatment) to 22° (after plasma treatment), thus increasing the wetting area accordingly.

Frequently, contact angle measurements using a variety of test liquids are analyzed by a two-parameter surface energy[21] to isolate the (London) dispersion, $\gamma^d sv$, and the (Keesom) polar, $^P sv$, contributions to the solid vapor surface tension, γsv:

$$\gamma sv = \gamma^d sv + \gamma^P sv$$

The surface energy of pretreated surfaces changes solely as a result of a change in the polar surface energy component without significant change in the dispersion surface energy component. Such change of character is related to a reaction between surface free radicals and air oxygen. It is evidenced by the appearance on the surfaces of $-C=O$, $C-O$, and COO groups in the infrared spectrum (*Table* 5). By means of x-ray photoelectron spectroscopy (XPS) the modification can be quantified.

Through attenuated total reflectance infrared (ATR-IR) analysis, the surface of an object can be analyzed in such a way that a multiple reflection infrared spectrum of the surface is obtained. The depth of penetration depends upon the actual wavelength of the measurements, which is ca. 1 micron at 2000 cm^{-1}. XPS measurements are used to release photoelectrons from the surface of an object by means of x-ray irradiation at a well defined energy. The energy of these photoelectrons is representative for a certain atom; only photoelectrons from the first ca. 5 nm of the surface can be analyzed.

It can be seen from *Table* 5 that the oxygen content on the surface of treated polypropylene increases upon treatment, thus increasing γ_{sv}.

The bond energy between the oxygen and the substrate depends on the pretreatment method, however. Whereas the oxygen content after flaming, plasma discharge, or chromic sulfuric acid (chemical) can partly be wiped off easily, the decrease after benzophenone/UV is much less. Obviously, the first method results only in physically bonded oxidized materials. The nature of the oxygen demonstrates that essentially an oxidation of the $C-C-$ or $C-H$ bonds of the polypropylene takes place. An exception to this is the nature of the oxygen after chemical pretreatment; in spite of the oxygen content of 16.5%, no $C-O$ or $C=O$ bonds can be detected, leading to the assumption that in this case the oxygen is bounded to the sulfur atom, for example, as SO_3H moeities.

The depth of penetration of a particular pretreatment method can be determined by laser microprobe mass spectroscopy (LMMS). Upon pulsing of the treated substrate with a laser ca. 0.2 microns of material is etched away, whereby the nature of the removed material is determined via mass spectroscopy. By repeating this laser pulsing on the same spot of the substrate, the depth of penetration can be reassured from the change in the mass spectrum as related to the number of laser shots. *Figure* 4 shows the pattern for chemically pretreated polypropylene after one and seven laser shots. The spectrum after

Table 5—Effect of Pretreatment Method on the Amount and Type of Oxygen on the Polypropylene Surface

Pretreatment Method	Percentage Total Oxygen Content Before Wiping	After Wiping Off	Surface Chemistry C–O	C=O	COO
Flaming	16.5	6.0	14.2	5.0	1.0
Plasma	14.5	4.0	10.3	6.0	2.0
Benzophenone/UV	21.0	15.0	6.3	9.4	3.1
Chemical	16.5	8.0	—	—	—

Table 6—Effect of Exposure Time of Polyethylene to Plasma on Contact Angles

PE Type	Untreated	Helium (5 sec)	Helium (8 sec)	Helium (30 sec)
HD	96.5	85	84	81
LD	97	76	87	68

seven laser shots is identical to that of untreated polypropylene, indicating that a depth of penetration of 1.0 to 1.5 mm is achieved through chemical pretreatment.

The effect of plasma exposure length on the polyolefin substrate was also shown to affect the wettability of the substrate. It can be seen in *Table* 6 that even very short-time exposure of a practically nonwettable polyethylene surface to helium plasma causes the contact angle to decrease measurably.

However, considerably greater effects are obtained by exposure of such materials to a somewhat longer time. In *Table* 7, exposure of a variety of polymer surfaces to plasma for three minutes is shown to significantly increase the surface energy and, thus, wettability.

COATINGS FOR POLYPROPYLENE

There are many disadvantages associated with the aforementioned pretreatment methods. For example, the plasma and corona discharge methods require a vacuum chamber, the flaming method poses a serious fire hazard in areas of high solvent density (i.e., paint booths), the benzophenone/UV process is expensive and time consuming, and the chemical pretreatment is corrosive.

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Other methods have been developed which involve the use of a chlorinated polyolefin "tie coat" to assist in the adhesion of topcoats to untreated polyolefins.[23] This method consists of applying a thin layer (micron level) of a dilute solution (<35%) of a chlorinated polyolefin (CPO) to the untreated polypropylene substrate. The thin layer is dried and then topcoated with conventional plastic coatings. Disadvantages associated with this method are: a high level of solvent is present; the thickness of the CPO layer is significant to resultant adhesion, that is, too thin of a layer leads to adhesive failure while too thick of a layer leads to cohesive failure; and the CPO is expensive.

Other methods exist which consist of applying modified CPOs as tie coats to untreated polyolefin. For example, silylated/CPO block copolymers[24] have been shown to adhere to untreated polypropylene. Acid or anhydride

Table 7—Effect of Plasma Exposure of Polymers on Surface Energy and Wetting[22]

Polymers	Surface Energy, Dynes Per Centimeter		Water Contact Angle Degrees	
	Initial[a]	Final[b]	Initial[a]	Final[b]
Hydrocarbons				
Polypropylene	29	>73	87	22
Polyethylene	31	>73	87	42
Polystyrene	38	>73	72.5	15
ABS	35	>73	82	26
Polyamide	<36	>73	63	17
Polymethyl methacrylate	<36	>73	Note[c]	Note[c]
Polyvinyl acetate/ polyethylene copolymer	38	>73	Note[c]	Note[c]
Epoxy	<36	>73	59.0	12.5
Polyester	41	>73	71	18
Rigid PVC	39	>73	90	35
Phenolic	Note[c]	>73	59	36.5
Fluorocarbons				
Polytetrafluoroethylene/ polyethylene copolymer	37	>73	92	53
Fluorinated ethylene propylene	22	72	96	68
Polyvinylidene fluoride	25	>73	78.5	36
Engineering thermoplastics				
PET	41	>73	76.5	17.5
Polycarbonate	46	>73	75	33
Engineering thermoplastics (cont'd)				
Polyimide	40	>73	79	30
Polyaramid	Note[c]	>73	Note[c]	Note[c]
Polyaryl ether ketone	<36	>73	92.5	3.5
Polyacetal	<36	>73	Note[c]	Note[c]
Polyphenylene oxide	47	>73	75	38
PBT	32	>73	Note[c]	Note[c]
Polysulfone	41	>73	76.6	16.5
Polyethersulfone	50	>73	92	9
Polyarylsulfone	41	>73	70	21
Polyphenylene sulfide	38	>73	84.5	28.5
Elastomers				
Silicone	24	>73	96	53
Natural rubber	24	>73	Note[c]	Note[c]
Latex	Note[c]	>73	Note[c]	Note[c]
Polyurethane	Note[c]	>73	Note[c]	Note[c]
Styrene butadiene rubber	48	>73	Note[c]	Note[c]
Fluoroelastomers				
Fluorocarbon copolymer elastomer	<36	>73	87	51.5

(a) Prior to plasma treatment.
(b) After plasma treatment.
(c) Data not available.

grafted butadiene-styrene copolymers blended with chlorinated maleic anhydride propylene copolymers[25] also were stated to adhere to untreated polypropylene. No further work was performed on either of these systems to determine if they could act as "weatherable" coatings.

The only cases published to date which consist of non-CPO coatings for application directly to untreated PP have been stated to exhibit good adhesion. Kielbania[26] demonstrated that a cyclohexylmethacrylate/isodecylacrylate copolymer adhered to untreated PP. Coney and Gossett[27] utilized a waterborne polyester-sulfonate metal salt (in which one component of the polyester was polyethyleneglycol) as an adherent coating to untreated PP. The latest published example capable of adhering directly to untreated PP consists of a fluoropolymer of undisclosed composition.[28]

ACKNOWLEDGMENTS

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Influence of Coalescing Aids In Associative Thickener Dispersions

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The transition in waterborne latex thickeners from nonassociative to associative types has highlighted many formulation sensitivities. The type and concentration of formulation surfactant, the particle size, size distribution, and stabilizing moieties on the latex and structure of the associative thickener have a pronounced effect on the application rheology and applied film properties of the coating. An understanding of these sensitivities in terms of the role of the coalescing aid is undertaken in this paper, using both commercial and experimental materials. The factors noted to be of primary importance are the surface topography and stabilizing moiety of the latex and the molar volume and hydrogen-bonding solubility parameter of the coalescing aid. These variables and their interactions in the complexities of fully formulated coatings are discussed.

INTRODUCTION

Waterborne latex coatings contain a matrix of components, each present for a specific function that in combination produce coatings with acceptable properties. The interactions among the components in coatings thickened with nonassociating cellulose ether have not been of major concern over the past two decades. Some of the restrictions[1,2] inherent in cellulose ether formulations have resulted in the acceptance of associative thickeners, but the latter formulations have proven more sensitive to changes in formulation components.

This investigation describes matrix sensitivities in formulations and in applied films. The sensitivities among the primary components of a latex paint—the latex, coalescing aid, and thickener—are studied in detail. Viscosities at low shear rates offer the best means for mechanistic interpretation and they are compared in series where the structure and morphology of the latex and the composition of the coalescing aid are varied in formulations thickened with hydroxyethyl cellulose and with different commercial associative thickeners. These interactions are examined using two model, hard [i.e., high glass transition temperature (T_g)] methyl methacrylate homopolymer latices. One of the latices contains methacrylic acid surface moieties (Latex A, *Table* 1) and the other, Latex B, does not contain these oligomeric electrosteric stabilizers. The influence of coalescing aids on two commercial latices (Rhoplex WL-51 and HG-74) are briefly examined and then followed by model, film-forming acrylic copolymer latex studies. Based upon these data, mechanistic interpretations of the influence of coalescing aids in associative thickener formulations conclude this study.

EXPERIMENTAL

LATEX SYNTHESIS: Various monodisperse latex series (e.g., methyl methacrylate homopolymer, and styrene

Table 1—Characteristics of the Latices in Subsection A

Latex	Composition	Particle Size (nm)	Surface Acid (meq/m2)
A	MMA[a]/MAA[b] (96/04)	220	0.00655
B	(100/00)	220	0.00028
C	(98/02)	240	0.00108
D	(97/03)	160	0.00214
	Rhoplex WL-51	Not determined	Not determined
	Rhoplex HG-74	100	0.00452

(a) Methyl methacrylate.
(b) Methacrylic acid.

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Table 2—Characteristics of the Latices in Subsection C

Latex Monomer	Wt% 1	2	3	4	5	6
Methyl methacrylate (MMA)	60	70	70	—	—	—
Styrene (S)	—	—	—	60	70	70
Ethyl acrylate (EA)	38	—	—	38	—	—
Butyl acrylate (BA)	—	28	—	—	28	—
2-Ethylhexyl acrylate (2-EHA)	—	—	28	—	—	28
Methacrylic acid (MAA)	02	02	02	02	02	02
T_g calculated°C	44	42	45	44	42	45
Solubility Parameters[a],						
Total, T	9.70	9.56	9.47	9.64	9.48	9.38
Nonpolar, NP	7.70	7.68	7.72	8.04	8.10	8.18
Polar, P	5.12	4.94	4.87	4.46	4.09	3.95
Hydrogen Bonding, H	2.88	2.77	2.42	2.80	2.66	2.29

(a) Weighted average values.
(b) A more detailed description of these binders will be given in a future manuscript.

and methyl methacrylate copolymers with ethyl, butyl, and 2-ethyl hexyl acrylate) containing different percentages (0-4%) of methacrylic acid were synthesized according to the procedure described by Donners and Peeters.[3]

Latices were synthesized by a semicontinuous process, under starved conditions at 80°C. In order to position the acid groups at the surface of the latex particle, the acid monomer was incorporated in the second half of the feed.[4] The pH of the latex was adjusted to 9 with ammonium hydroxide at 45-55°C. The compositions and properties of the latices synthesized are listed in *Tables* 1 and 2.

LATEX CHARACTERIZATION: Determination of the latex median particle size and surface acid compositions are described in a previous manuscript.[5] The distribution of the coalescing aid between the latex and the aqueous phase was determined by gas chromatography of the serum after methanol dilution and immediate centrifugation to separate the latex.

COALESCING AIDS: Coalescing aids were requested and received from most suppliers of these materials, and are employed throughout these studies as received. Most were acknowledged to be blends, and it is very likely that none of the coalescing aids are pure compounds. Structures of the coalescing aids used in this study are given in *Table* 3, with the abbreviations that will be used for the materials in the Results and Discussion section. The coalescing aids are used at concentrations appropriate to the specific study undertaken.

Table 3—Coalescing Aids; Structures and Solubility Parameters

Coalescing Aids[a]	Abbreviations	Solubility Parameters NP	P	H	T
$(CH_3)_2CH0OC(CH_2)_nCOOCH(CH_3)_2$ n = 2:15.4%; n = 3:66.4%; n = 4:17.9% Dibasic ester (isopropyl)	DBE-IP[b]	6.86	4.31	3.23	8.72
$(CH_3)_2CHCHOHC(CH_3)_2CH_20COCH(CH_3)_2$ 2,2,4-Trimethyl-1,3 Pentanediol Monoisobutyrate	TPIB[c]	6.16	3.83	4.20	8.38
$C_4H_9(OCH_2CH_2)_2OOCCH_3$ Butyl carbitol acetate	BCA[d]	6.94	3.97	4.25	9.05
$C_2H_50OC(CH_2)_nCOOC_2H_5$ n = 2:13.7%; n = 3:70.8%; n = 4:15.1% Dibasic ester (ethyl)	DBE-Et[b]	6.89	4.72	4.37	9.43
$CH_3OOC(CH_2)_4COOCH_3$ Dialkyl adipate (methyl)	DAA-Me[b]	6.90	5.04	4.77	9.79
$CH_3OOC(CH_2)_nCOOCH_3$ n = 2:16.5%; n = 3:66.0%; n = 4:17.0% Dibasic ester (methyl)	DBE-Me[e]	6.97	5.47	5.54	10.45
$C_4H_9(OCH_2CH_2)_2OH$ Butyl carbitol	BC[f]	6.51	3.94	6.16	9.79
$C_6H_5OCH_2CH(CH_3)OH$ Propylene glycol phenyl ether	PPh[g]	6.81	5.28	6.42	10.74
$C_6H_50CH_2CH_2OH$ Ethylene glycol phenyl ether	EPh[g]	6.81	5.62	7.31	11.46
$(CH_3)_2COHCH_2CHOHCH_3$ 2-Methyl-2,4-Pentanediol (Hexylene glycol)	HG	5.73	5.80	8.20	11.56

(a) Some of these are acknowledged to be mixtures; it is very probable that all of the commercial coalescing aids are blends of more than one compound.
(b) Experimental products of E.I. du Pont de Nemours & Company.
(c) Texanol; registered tradename of Eastman Chemicals.
(d) Ektasolve BD Acetate; registered tradename of Eastman Chemicals.
(e) DBE Dibasic Ester; registered tradename of E.I. du Pont de Nemours & Company.
(f) Product of Union Carbide.
(g) Dowanol; registered tradename of Dow Chemicals.

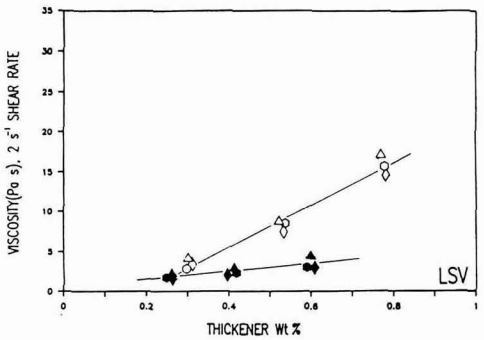


Figure 1—Effect of coalescing aids on the low shear rate (2 s^{-1}) viscosity (Pa s) of 0.32 volume fraction dispersions of Latex B, *Table* 1 plus titanium dioxide [stabilized with sodium hydroxide neutralized 5,000 M.W. poly(methacrylic acid)] at a pigment to pigment plus latex ratio of 0.21, thickened with HEC (open symbols) and HEUR708 (closed symbols). Coalescing aids: TPIB—Destabilized; ○—BCA; △—DBE-Me; ◇—BC. (CA abbreviations are clarified in *Table* 3)

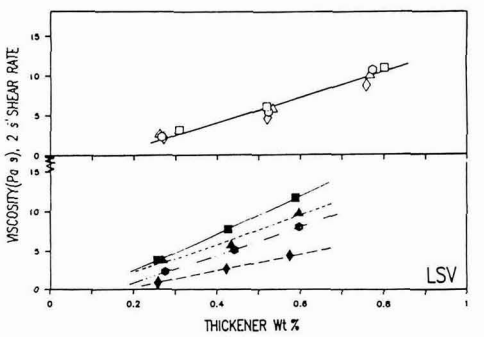


Figure 2—Effect of coalescing aids on the low shear rate (2 s^{-1}) viscosity (Pa s) of 0.32 volume fraction dispersions of Latex A, *Table* 1, plus titanium dioxide [stabilized with sodium hydroxide neutralized 5,000 M.W. poly(methacrylic acid)] at a pigment to pigment plus latex ratio of 0.21, thickened with HEC (upper) and HEUR-708 (lower). Thickener and coalescing aid symbols are given in *Figure* 1

THICKENERS: The thickeners used in this study are discussed in a previous study.[6,7] HEUR is an acronym for hydrophobe modified ethoxylated urethane. The number that follows is a commercial designation.

COATING FORMULATIONS: Coatings with 0.32 total nonvolatiles volume fraction at a pigment to pigment plus latex ratio of 0.21 were formulated according to a procedure previously described.[7]

RESULTS

The significance of associative thickeners in waterborne latex technology was rapidly surveyed through the use of commercial materials in the initial phase of our efforts. Small[7] (all-acrylic) and large particle[8] (vinyl-acrylic) latices were examined; the all-acrylic latices generally contained surface acid stabilizing moieties[4] and all of the vinyl-acrylic latices contained chemically grafted hydroxyethyl cellulose fragments.[9] The influence of associative thickeners on the rheology of the large particle latex was insignificant, in agreement with a previous study that examined such latices[10] that are currently the largest sales volume binders among vinyl/acrylate and all-acrylic resins. The emphasis of this study centers on small particle latices.

THE INFLUENCE OF COALESCING AID ON COATINGS RHEOLOGY

"Coatings" Containing Ideal, High T_g PMMA Homopolymer Latices

The study began with a colloid chemist's view of an ideal polymer colloid: a hard (i.e., high T_g) homopolymer of methyl methacrylate, monodisperse and 220 nm in size. This first ideal latex was synthesized with (Latex A, *Table* 1) and without (Latex B) methacrylic acid via a semibatch process[4] (to produce methacrylic acid oligomer segments on the surface of Latex A). Surface acids are common in small acrylic latices; they produce latices with freeze thaw and mechanical stability. Coatings were prepared with these ideal latices; the formulations contained coalescing aids (7 wt% on latex solids) not because the coalescing aid would lower the modulus of these high T_g latices enough to form films, but because they are used universally in coating formulations. The formulations were prepared in most of the series of this study by adding thickeners in varying amounts to obtain three or four different Stormer viscosities [(80), 90, 105, and 120 KU]. The viscosity dependence at high (10^4) and low ($2s^{-1}$) shear rates on the weight percent of thickener provides both a means of understanding the mechanism of thickening and the relative cost performance of each thickener. Studies with the "ideal" latices A and B (*Table* 1) produced two significant observations:

(1) The coating with Latex B flocculated in formulations containing the industry standard thickener and coalescing aid of the past two decades [HEC and 2,2,4-trimethyl-1,3-pentanediol monoisobutyrate (TPIB, Texanol®)]. If more hydrophilic coalescing aids and open time agents were employed, the formulations maintained their stability. Differences in Latex B low shear rate viscosities (*Figure* 1) with the hydrophilic coalescing aids were not observed, but most exhibited syneresis in HEUR 708 thickened formulations.

(2) The formulations containing Latex A with surface acids were stable even with the most hydrophobic coalescing aid. Variations in the low shear viscosities were observed in formulations thickened with HEUR-708, but not in formulations thickened with HEC (*Figure* 2). With this acid stabilized latex, syneresis was not observed in HEUR-708 formulations. Parallel trends in high shear viscosities also were observed (*Figures* 3 and 4).

Flocculent structures impart shear thinning behavior to dispersions. The viscosity dependence on shear rate of intermediate surface acid PMMA latices (Latices C and

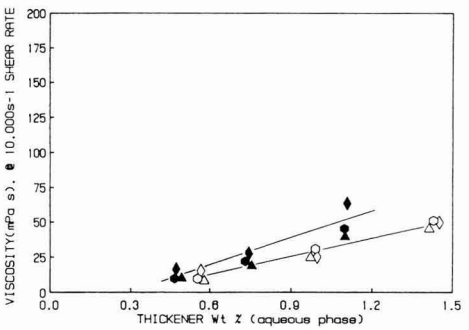


Figure 3—Effect of coalescing aids on the high shear rate (10,000 s^{-1}) viscosity (mPa s) of 0.32 volume fraction dispersions of Latex B, *Table* 1, plus titanium dioxide (stabilized with sodium hydroxide neutralized 5,000 M.W. poly(methacrylic acid) at a pigment to pigment plus latex ratio of 0.21. Thickener and coalescing aid symbols are given in *Figure* 1

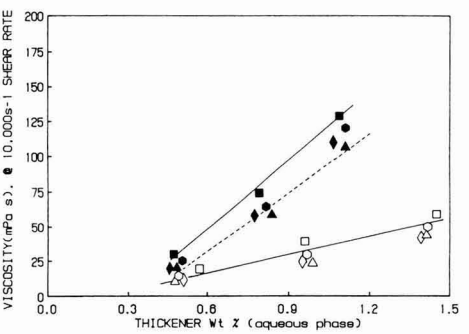


Figure 4—Effect of coalescing aids on the high shear rate (10,000 s^{-1}) viscosity (mPa s) of 0.32 volume fraction dispersions of Latex A, *Table* 1, plus titanium dioxide (stabilized with sodium hydroxide neutralized 5,000 M.W. poly(methacrylic acid) at a pigment to pigment plus latex ratio of 0.21. Thickener and coalescing aid symbols are given in *Figure* 1

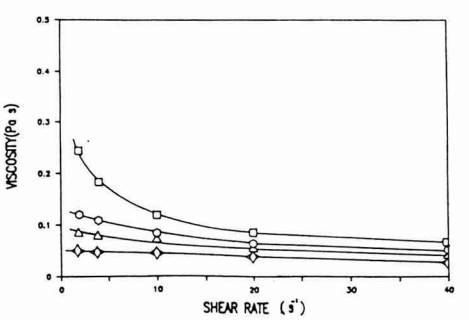


Figure 5—Viscosity (Pa s) dependence on shear rate (s^{-1}) of Latex C, *Table* 1, at 50% solids dispersion containing 10% CA on the weight of latex polymer. Coalescing aids: □—TPIB; ○—BCA; △—DBE-Me; ◇—BC; ◇—HG. (CA abbreviations are clarified in *Table* 3)

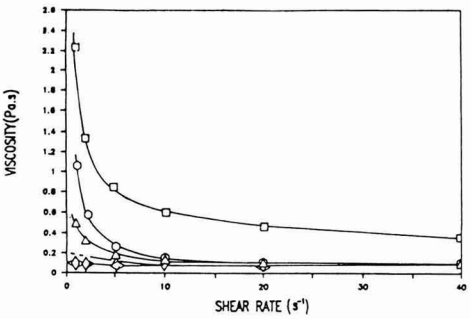


Figure 6—Viscosity (Pa s) dependence on shear rate (s^{-1}) of Latex D, *Table* 1, at 50% solids dispersion containing 10% CA on the weight of latex polymer. Thickener and coalescing aid symbols are given in *Figure* 5

Table 4—Blocking Resistance of Coatings. (PVC-21; %NVV-32; HEC-0.5%) Containing 15 wt% Coalescing Aids Based on the Latex Polymer

Latex:		MMA/EA/MAA				S/2EHA/MAA			
Coalescing Aid		Time (Days)							
Type	V_m[a]	1	2	3	4	1	2	3	4
TPIB	227.7	B[b]	B	B	B	B	B	B	B
DBE-IP	223.2	B	B	B	B	B	B	LB	NB
BCA	208.4	B	B	LB	NB	B	LB	NB	NB
DBE-Et	184.7	B	B	LB	NB	B	LB	NB	NB
BC	170.1	B	B	LB	NB		No film		
DAA-Me	164.6	B	B	LB	NB	B	NB	NB	NB
DBE-Me	146.5	B	B	NB	NB	B	NB	NB	NB
PPh	143.2	B	B	LB	NB	B	LB	NB	NB
HG	127.8	B	B	B	B		No film		
EPh	125.2		DS[c]				No film		

(a) V_m = molar volume of coalescing aids.
(b) B = blocking; LB = little blocking; NB = no blocking.
(c) Paints were destabilized during the incorporation of coalescing aids.

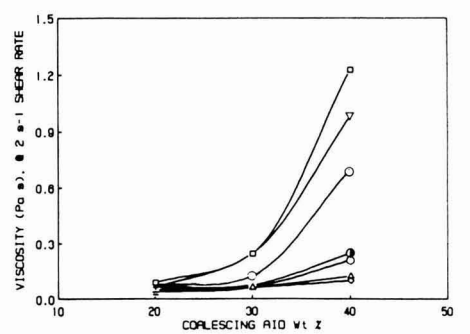


Figure 7—Effect of coalescing aids on the low shear rate (2 s^{-1}) viscosity (Pa s) of the 0.32 volume fraction dispersion of latex (Rhoplex WL-51) plus pigment (stabilized with sodium hydroxide neutralized 5,000 M.W. poly(methacrylic acid). Coalescing aids: □—TPIB; ▽—DBE-IP; ○—BCA; △—DBE-Me; ◇—BC; ○—PPh; ◑—EPh. (CA abbreviations are clarified in *Table* 3)

Table 5—Blocking Resistance of Films of Commercial Latex (Rhoplex HG-74, 100 nm; T_g:39°C) Coatings. (PVC-21; % NVV-32; 15% CAs)

CA. Type	Thickener	Hours 4	9	12
TPIB.....	HEC	B[a]	NB	NB
	SMAT	B	NB	NB
	HEUR-708	B	B	LB
	HEUR-270	B	B	NB
	HEUR-200	B	B	NB
BCA.....	HEC	NB	NB	NB
	SMAT	NB	NB	NB
	HEUR-708	B	NB	NB
	HEUR-270	NB	NB	NB
	HEUR-200	B	NB	NB
DBE-Me.....	HEC	B	NB	NB
	SMAT	B	NB	NB
	HEUR-708	B	B	NB
	HEUR-270	B	NB	NB
	HEUR-200	B	NB	NB
BC	HEC	NB	NB	NB
	SMAT	NB	NB	NB
	HEUR-708	NB	NB	NB
	HEUR-270	NB	NB	NB
	HEUR-200	NB	NB	NB
HG	HEC	B	NB	NB
	SMAT	B	NB	NB
	HEUR-708	B	NB	NB
	HEUR-270	B	NB	NB
	HEUR-200	B	NB	NB

(a) B = blocking; LB = little blocking; NB = no blocking.

D, *Table* 1) at a 50% solids level but without pigment and thickener is illustrated in *Figures* 5 and 6. The dispersions containing the more hydrophobic coalescing aids are shear-thinning.

Commercial Latex Studies

The study of coalescing aid influences on viscosity at low shear rates was extended to two commercial binders, Rhoplex WL-51 and HG-74. The Rhoplex WL-51 (T_g: 63°C) latex is designed to obtain the required formulation viscosity by adjusting the pH of the dispersion and by varying the amount and type of coalescing aids. Coalescing aids levels of 20, 30, 40%, and one level, 15%, of open time agent, ethylene glycol, based on weight of latex, were incorporated in formulations containing the same volume fraction of latex and PVC. Water-soluble thickeners were not added to these formulations. The results follow the trend observed with the model, hard sphere PMMA Latices C and D; the more hydrophobic the coalescing aid the higher the viscosity at low shear rates (*Figure* 7). These results led to a broader examination of coalescing aids. The structures of these materials with their three-part solubility parameters (calculated from regression constants[11,12]) are listed in *Table* 3.

A styrene based 100 nm latex (Rhoplex HG-74) was used in the broader spectrum coalescing aid/open time agent study. The concentration of the additives in pigmented formulations was 15 wt% based on the latex. The viscosities at a 2 s^{-1} shear rate (LSV) are illustrated in *Figure* 8 for formulations thickened with hydroxyethyl cellulose and three commercial HEUR thickeners at several levels. The LSVs are similar to those observed with the model PMMA Latex A. The LSVs in the hydroxyethyl cellulose formulations do not vary within experimental error with changes in the coalescing aid or open time agent. The LSV sensitivity at these higher coalescing aid levels (15%) with this relatively high T_g (39°C) commercial latex are more pronounced in the HEUR 708 and 270 formulations and are proportional to the hydrophobicity (reflected by the total solubility parameter) of the coalescing aid.

Model Film-Forming Latex Studies

Two monomers commonly used, styrene and methyl methacrylate, were copolymerized with three acrylates to obtain model film-forming latices. The comonomers (and the weight percents) required to produce latices with a T_g of approximately 45°C, an appropriate temperature for evaluation of the comparative performance of coalescing aids, were ethyl acrylate (38%), butyl acrylate (28%), and 2-ethylhexyl acrylate (28%). The matrix of compositions and calculated solubility parameters, excluding contributions of the methacrylic acid functionality, are given in *Table* 2. This series of latices allowed evaluation of the coalescing agents with latices of variable hydrophilicity.

The six latices in total were used to examine film formation, latex destabilization (shock), hardness development, and block resistance of films. The development of hardness in films containing 25 wt% coalescing aid (*Figure* 9) parallels the results of block resistance in formulations thickened with HEC (*Table* 4). Both appear to be related to the rate of evaporation and to the molar

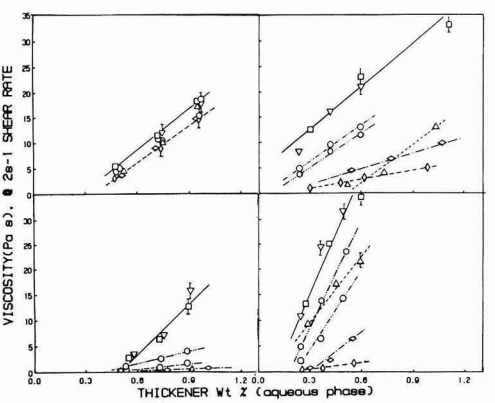


Figure 8—Effect of coalescing aids on the low shear rate (2 s^{-1}) viscosity (Pa s) of dispersions containing 0.32 total volume fraction of latex (100 nm, styrene based latex; T_g: 39°C; 0.00452 meg/m² surface acid) plus titanium dioxide (stabilized with sodium hydroxide neutralized 5,000 M.W. poly (methacrylic acid) at a pigment to pigment plus latex volume ratio of 0.21. 15 wt% coalescing aids based on latex polymer. Coalescing aids: ▽—DBE-IP; □—TPIB; ○—BCA; △—DBE-Me; ◇—BC; ○—PPh; ◇—HG. (CA abbreviations are clarified in *Table* 3). Thickeners: A—HEC; B—HEUR708; C—HEUR200; D—HEUR270

Table 6—Concentration of Coalescing Aids (Wt%) in Polymer and Aqueous Phases in 50% Latex Solids Dispersions

Latex		MMA/EA/MAA (60/38/02)		STY/2EHA/MAA (70/28/02)	
CA	Wt%[a]	Polymer	Serum	Polymer	Serum
TPIB	10	9.87	0.13	9.87	0.13
	15	14.87	0.13	14.78	0.22
	20	19.87	0.13	19.87	0.22
DBE-IP	10	9.91	0.09	9.87	0.13
	15	14.87	0.13	14.91	0.09
	20	19.87	0.13	19.87	0.13
DBE-Me	10	4.78	5.22	4.12	5.88
	15	6.51	8.49	4.88	10.12
	20	9.55	10.45	7.26	12.74
BCA	10	9.98	0.013	9.81	0.19
	15	14.81	0.19	13.44	1.56
	20	18.63	1.37	15.69	4.31
PPh	10	7.29	2.71	4.91	5.09
	15	11.9	3.10	7.03	7.97
	20	17.1	2.90	11.02	8.98
EPh	10	Destabilized		3.4	6.6
	15	Destabilized		5.21	9.79
	20	Destabilized		6.45	13.55

(a) Initial concentrations of CAs based on the weight of polymer.

volume of the coalescing aid. Block resistance tests of films obtained from associative thickener formulations containing the commercial styrene latex do not exhibit parallel trends (*Table* 5). This may be partly attributed to the low T_g of the poly(oxyethylene) segments of the associative thickener and to partial crosslinking in the commercial latex, with a material such as divinyl benzene. A more fundamental understanding of the contribution of individual associative thickeners as a function of their oxyethylene chain lengths and hydrophobe frequencies to block resistance is needed.

For a given latex, the plasticizer's distribution is governed by its hydrogen bonding solubility parameter[13] (*Table* 3). Although the importance of different surface morphologies has not been addressed in previous latex studies, the distribution of the coalescing aids (*Table* 6) between the aqueous and the two model latices with the largest difference in hydrophobic characteristics: MMA(60%)/EtAcr(38%) vs Sty(70%)/2-EtHexAcr(28%) support such a difference in topography. The difference envisaged (*Figure* 10) would be porous for the hydrophilic latex and a smooth, less penetrable surface morphology for the most hydrophobic latex. The block resistance of films (*Table* 4) formed from these two model latices of greatest hydrophobic difference also supports the different surface morphologies, the more hydrophilic Butyl Carbitol® plasticizes the porous MMA based latex, affecting film formation, but this is not observed with the styrene based latex. Support for this difference in morphology also is evident in the minimum amounts required to film the latex (*Table* 7) and associated gloss data of the films obtained from all six latices (*Tables* 8 and 9).

INFLUENCE OF COALESCING AIDS ON THE ASSOCIATIVE MECHANISM

It is appropriate to review the data from previous studies before addressing the role of coalescing aids in associative thickener formulations. The surface of Latex B (*Table* 1) synthesized without methacrylic acid is not

Table 7—Coalescing Aids: Concentration Effects

Latex[a]	T_g (expt.) (°C)	CA. Type[c]	Amount required to form films[b] TPIB	DBE-Me	DAA-Me	DBE-Et	DBE-IP	BCA	PPh	EPh	BC	HG	Conc. latex Destabilizing EPh	BC	HG
MMA/EA/MAA	52		10	10	10	10	10	10	10	DS[d]	10	10	DS	>10	>10
MMA/BA/MAA	54		15	15	15	15	15	15	15	DS	15	*[e]	DS	>25	>10
MMA/2EHA/MAA	55		15	15	15	15	15	15	15	DS	*	*	DS	>25	>30[f]
S/EA/MAA	54		15	15	15	15	15	15	15	DS	*	*	DS	>30	>30
S/BA/MAA	59		15	15	15	15	15	15	15	—	*	*	—	>30	>30
S/2EHA/MAA	51		15	15	15	15	15	15	15	20	*	*	>30	>30	>30

(a) Latex compositions are given in the *Table* 2.
(b) Wt% of CA based on the polymer.
(c) Chemical identifications of coalescing aids are given in *Table* 3.
(d) Strong destabilization.
(e) Film is not uniform, often it is clear without cracks, sometimes the film contains cracks.
(f) Stable up to the maximum level (30%) incorporated.

Table 8—Gloss (20°) of Unpigmented Films with 15 Wt % Coalescing Aid

Latex[a]	CA. Type	TPIB	BCA	DBE-Me	BC	HG
MMA/EA/MAA (60/38/02)		+[b]	+	+	DS[c]	DS
MMA/BA/MAA (70/28/02)		75	+	65	*[d]	*
MMA/2EHA/MAA (70/28/02)		35	42	30	*	*
S/EA/MAA (60/38/02)		60	65	32	*	*
S/BA/MAA (70/28/02)		50	50	30	*	*
S/2EHA/MAA 70/28/02		52	35	52	*	*

(a) See *Table* 2.
(b) No cracks, gloss reading greater than scale maximum.
(c) At 15 Wt % CA level the latex was unstable.
(d) Film is not uniform, often it is clear without cracks, sometimes the film contains cracks.

saturated with the synthesis surfactant;[5] approximately 30% of the surface is available. There is, however, an excess of the formulation surfactant, branched (b)-$C_{13}H_{27}(OCH_2CH_2)_9OH$, which is added with the titanium dioxide. When the pigment is treated with an oligomeric methacrylic acid (i.e., a dispersing aid such as Tamol 850 (Rohm and Haas Company), which is the standard practice in formulating latex coatings) the nonionic surfactant is not adsorbed on the surface of titanium dioxide.[14] The surface of Latex B, therefore, should be saturated in the fully formulated coating. Under these conditions, associative thickener hydrophobe participation in formulation surfactant micelles, and ion-dipole

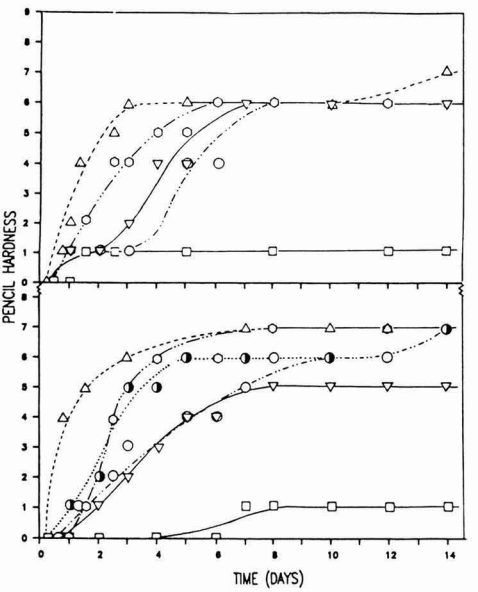
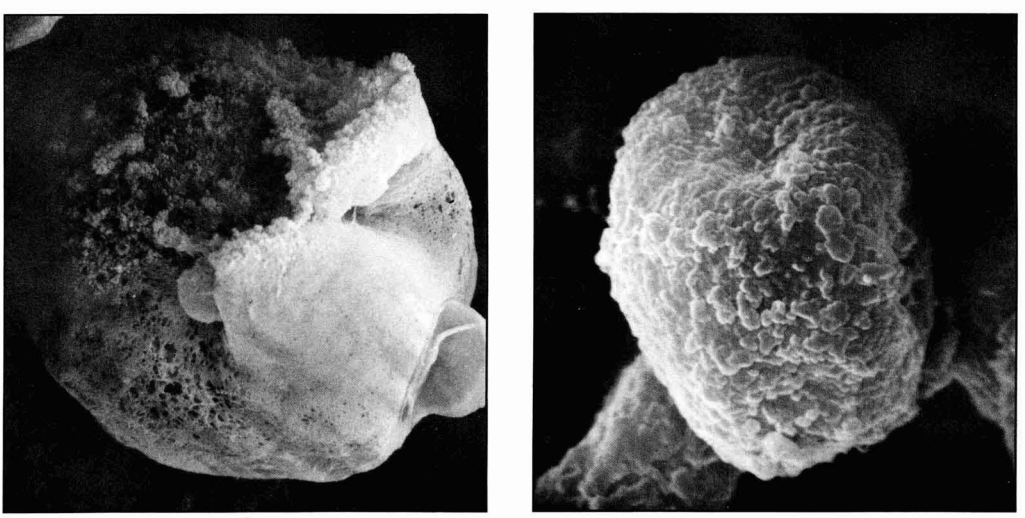


Figure 9—(a) Hardness development (pencil hardness test, ASTM D 3363-80) of MMA/EA/MAA (68/38/02) latex (*Table* 2) films containing 25% coalescing aids on weight of polymer. (b) Hardness development (pencil hardness test, ASTM D 3363-80) of Sty/2-EHA/MAA (78/28/02) latex (*Table* 2) films containing 25% coalescing aids on weight of polymer. CA symbols given in *Figure* 8



A B

Figure 10—Illustration depicting polymer colloid surface containing A—hydrophilic monomers and B—hydrophobic monomers

Table 9—Improvement of Gloss, Scrub Resistance, and Flexibility of Films with the Level of Coalescing Aids. (PVC-14; %NVV-32; HEC-0.5%)

Coalescing Aid		MMA/EA/MAA			S/2EHA/MAA		
		Gloss[a]		Scrub resistance	Gloss[a]		Scrub resistance
Type	Wt %	60	20	(No. of strokes)	60	20	(No. of strokes)
None		33	2	7	47	8	7
TPIB	10	57	15	240	60	18	230
	15	70	30	300	74	28	250
	20	80	42	350	77	32	300
DBE-IP	10	71	36	210	73	30	160
	15	73	38	275	78	35	185
	20	82	50	350	77	33	300
DBE-Et	10	59	18	200	74	28	200
	15	80	47	340	77	34	240
	20	77	35	375	77	28	300
DAA-Me	10	76	40	175	72	29	130
	15	81	47	300	77	33	270
	20	68	24	400	75	30	300
DBE-Me	10	70	31	150	60	21	110
	15	72	33	200	65	19	140
	20	66	23	300	70	24	175
BCA	10	64	22	200	72	28	250
	15	75	38	400	72	25	300
	20	78	41	500	72	26	350
PPh	10	79	42	230	76	32	175[b]
	15	82	48	400	77	31	225
	20	67	23	400	78	32	375
EPh	10		Destabilized		72	25	150[b]
	15		Destabilized		72	25	210[c]
	20		Destabilized		78	29	300[c]
BC	10	73	33	115[c]	23	6	20[b]
	15	78	33	230	17	2	16[b]
	20	76	35	400	28	3	16[b]
HG	10	54	13	67[c]	57	18	10[b]
	15	67	25	110	57	16	10[b]
	20	77	41	225	40	6	9[b]

(a) Gloss of films after drying at room temperature for 10 days.
(b) Poor flexibility.
(c) Fair flexibility (cracks developed only at the sharp end of the conical mandrel).

Note: Flexibility of films were good except those with superscripts b and c.

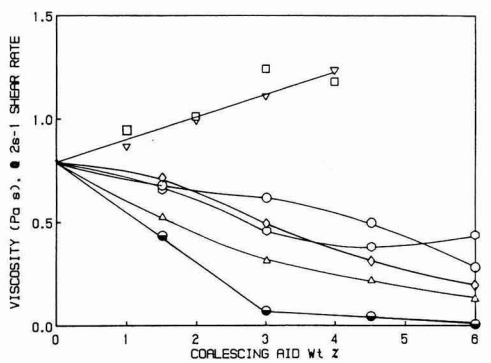


Figure 11—The influence of coalescing aids concentration on the low shear rate (2 s^{-1}) viscosity (Pa s) of 2 wt % HEUR-270 solution. Coalescing aids: ▽—DBE-IP; □—TPIB; ⬡—BCA; △—DBE-Me; ◇—BC; ○—PPh; ◑—EPh (CA abbreviations are clarified in *Table* 3)

interactions between the surface carboxylate cations and the ether linkages of the associative thickener's oxyethylene chains have significant roles[6] in determining the viscosity of coating formulations containing 220 nm latices. With this in mind, by what mechanism(s) do hydrophobic coalescing aids effect an increase in the formulation's low shear rate viscosity?

The distribution data in *Table* 6 indicate that the more hydrophobic coalescing aids distribute principally into the latex. Absorption into and expansion of the latex particle would increase the viscosity, which would be reflected in both low and high shear rate viscosities. The difference in high shear rate viscosities is marginal in Latex A dispersions containing HEUR-708 (*Figure* 4) and the commercial 100 nm latex, Rhoplex HG-74. In addition, the differences in low shear rate viscosities in the hydroxyethyl cellulose thickened dispersions (*Figure* 2) are within experimental error. The low shear viscosity increase due to swelling of the latex by the more hydrophobic coalescing aid therefore is not a viable mechanism. The ineffectiveness in forming films with the high T_g, model Latex B, with the larger hydrophobic coalescing aids also negates absorption into the latex for the model binders studied. For example, films could not be

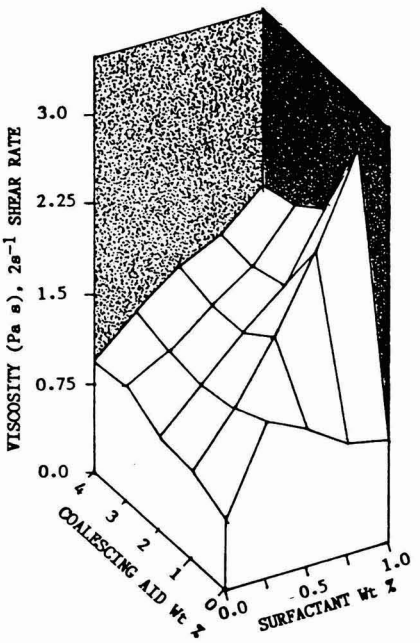


Figure 12—Effect of coalescing aid (TPIB) and nonionic surfactant ($b-C_{13}H_{27}$ $(OCH_2CH_2)_9OH$) on the low shear rate (2 s^{-1}) viscosity (Pa s) of 2 wt % HEUR-270 solution

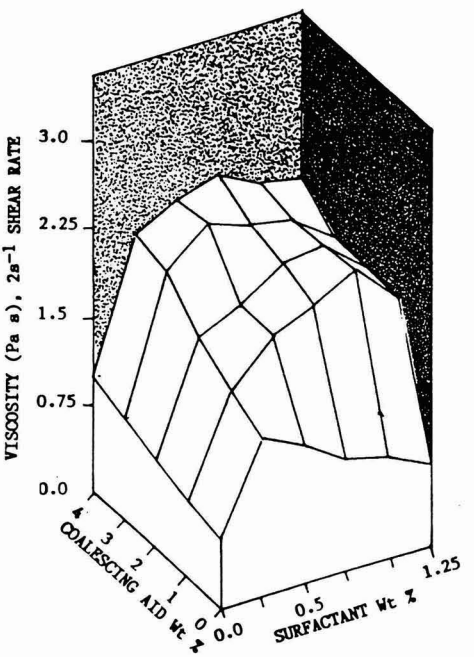


Figure 13—Effect of coalescing aid (DBE-IP) and nonionic surfactant ($b-C_{13}H_{27}$ $(OCH_2CH_2)_9OH$) on the low shear rate (2 s^{-1}) viscosity (Pa s) of 2 wt % HEUR-270 solution

formed with TPIB and the diisopropyl ester of the dibasic acid blend, even when these coalescing aids were employed up to 40 wt% on latex solids. Only dry powders are observed with Latex B when the dispersions are applied. Films could be formed with the dimethyl ester of DBE, but they were marginal in quality. The molar volume of the coalescing aid appears to play a role.

Three viable mechanisms are considered in the following; the contribution of each is dependent on the properties of the components used in a coating formulation. Surfactant transport from the latex's surface in the model dispersion to the continuous media can increase the "effective volume fraction" of the dispersion by causing partial flocculation of the latex. Entrainment of some of the continuous phase in the interstices of the partially flocculated latex effects an increase in the effective volume fraction of the dispersed phase and thereby an increase in the dispersion's viscosity. This is perhaps most evident in the flocculation of model Latex B, the binder without MAA surface acid stabilization, which was only 70% covered. However, the phenomenon also is observed in the hard, model Latices C and D with intermediate surface acids. Flocculation occurs in hydroxyethyl cellulose thickened dispersions as well as HEUR formulations and without thickener in Latices C and D. The surfactant could be transported into the latex's interior, as has been reported[15] for low T_g vinyl acetate/butyl acrylate copolymers. This also would affect the partial flocculation.

Surfactant transport into the continuous media also could provide a third mechanism for the viscosity increase through a second complementary increase in the effective volume fraction of the dispersed phases by stabilizing insoluble coalescing aid micelles. The viability of the effective volume fraction increase by stabilizing the hydrophobic coalescing aid emulsions in the aqueous phase is supported by data illustrated in *Figures* 11-13 and would increase in importance with the T_g of the latex. The coalescing aid or open time additives with limited or total solubility in the aqueous phase serve to dilute that phase and decrease the viscosity. They change the nature of the continuous media, as noted in a previous study[16] and may form mixed micelles,[17] which could minimize the driving force for the interaction of thickener hydrophobes in the aqueous solution.

The viscosity of both hydrophobic coalescing aids (TPIB and the diisopropyl ester of the dibasic acid) increase with increasing concentrations. Neither coalescing aid, however, is soluble in the aqueous phase, and both separate on standing. With addition of the formulation surfactant to the associative thickeners/coalescing aid matrix, both coalescing aids form a stable milky dispersion in the aqueous phase. Increases in viscosity of the matrix are illustrated in *Figures* 12 and 13 for the two effective coalescing aids. The commercial cosolvent and other possible additives were removed from the associative thickener before preparing the dispersions.

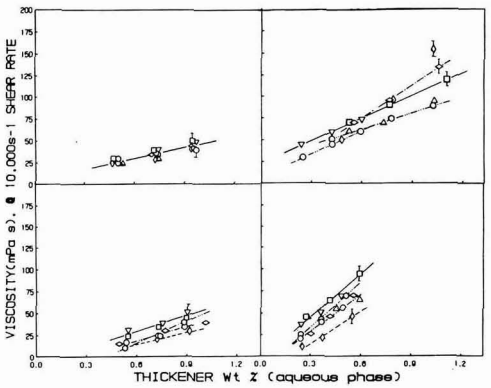


Figure 14—Effect of coalescing aids on the high shear rate (10^4 s^{-1}) viscosity (mPa s) of dispersions containing 0.32 total volume fraction of latex (100 nm, styrene based latex; T_g: 39°C; 0.00452 meg/m² surface acid) plus titanium dioxide (stabilized with sodium hydroxide neutralized 5,000 M.W. poly (methacrylic acid) at a pigment to pigment plus latex volume ratio of 0.21. 15 wt % coalescing aids based on latex polymer. Coalescing aids and thickeners defined in *Figure* 8, CA abbreviations are clarified in *Table* 3

The coalescing aid does not contribute to the high shear rate viscosity of associative thickener formulations (*Figure* 14), which is the most important rheological parameter in the application of a waterborne latex coating. Factors influencing the viscosities at high shear rates in fully formulated coatings will be considered in a future article.

CONCLUSION

Understanding the behavior of coalescing aids in associative thickener formulations is complex. Without the coalescing aid, associative thickeners viscosify by the participation of the associative thickener's hydrophobes in the low molecular weight surfactant micelles and by ion-dipole associations among latex surface carboxylate cations with the ether linkages of the HEUR associative thickener. With the correct structural features, the associative thickener may also associate with the latex through hydrophobic interactions. The participation of the coalescing aid in associative thickener dispersions is most evident in the instability of the 220 nm acid-monomer free PMMA latices. Surfactant is taken from the surface of that latex, causing the instability, partial flocculation, and a subsequent increase in the viscosity of the formulation. It occurs in hydroxyethyl cellulose thickened dispersions as well as HEUR formulations. Surfactant transport from the hard acid-monomer-free PMMA latex surfaces may also increase the "effective volume fraction" by stabilizing swollen coalescing aid micelles, and thereby increased dispersion viscosity. The observation that surfactant can penetrate the latex (as has been reported for vinyl acetate latices) is appealing, and in lower T_g commercial film-forming latices, absorption of formulation and synthesis surfactant with the coalescing aid is also a viable mechanism for effecting associative thickener dispersion rheology.

Other observations of significance are the dependence of the distribution of coalescing aids on the latex's hydrophilicity and topography and the importance of the coalescing aid's molar volume to hardness development and block resistance of the applied film. Finally, the high shear rate viscosity of coating formulations is not dramatically influenced by the coalescing aid. This parameter of primary importance to coating chemist will be discussed in a future article.

ACKNOWLEDGMENT

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REVIEW PAPER

Calculation of Boiling Points From the Number of Homolog Carbons

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The linearity of $(T_b,K)^{1/2}$, where T_b is the boiling point, with the logarithms of chain length (represented by the number of carbons, N_c, or by molecular weight, M), was used to develop simple equations correlating $(T_b,K)^{1/2}$ with $(N_c + k)$ or M for more than 100 homologous series. Boiling points defined by the equations are presumed to be correct, whereas those in substantial disagreement are considered wrong. The equations can be used to estimate many new boiling points by interpolation or by prudent extrapolation. Simple equations are given that correlate n-alkane boiling points with critical temperatures, freezing points, surface tensions, densities, refractivities, and heats of vaporization.

Simple equations that correlate homolog properties (including boiling points, T_b,K) with the number of carbons (N_c) or molecular weight (M) have several important advantages: they are easy to use; much information is provided in little space; experimental or literature properties that agree with the calculated properties probably are correct, whereas those in gross disagreement are incorrect; and properties of additional compounds can be estimated by interpolation and prudent extrapolation. [Most homologs can be represented by RG, where R is an n-alkyl group and G is a functional group, such as hydroxyl (−OH) or carboxyl (−COOH).]

Many of the previously-proposed equations for correlating homolog properties with N_c or M are complex or are useful only over limited carbon spans.[1–5] It was found recently[6,7] that several homolog properties can be correlated, by simple expressions [equations (1-4)], with logarithms of homolog chain length (L):

$$T_c,K = b + m \log L \quad (1)$$

$$(T_b,K)^{1/2} = b + m \log L \quad (2)$$

$$(T_m,K)^2 = b + m \log L \quad (3)$$

$$\gamma^e = b + m \log L \quad (4)$$

where T_c is the critical temperature, T_m is the melting point, K is degrees Kelvin, γ is the surface tension, e is a small number, b is the intercept, m is the slope, and L is represented by either N_c or M.

This paper provides least-squares expressions [equations (5 or 6)] that correlate boiling points with either N_c or M for the members of more than 100 homologous series; the high correlation coefficients (r) show that the agreement between the calculated and literature values is good (*Tables* 1-7). The n-alkane equation in *Table* 1, which is valid over the range of $C_5 - C_{33}$, shows that equation (5) can cover a wide carbon span. The equations in *Table* 7 show that equation (5) is applicable to boiling points at many pressures, that is, from 0.001 to 760 torr.

$$(T_b,K)^{1/2} = b + m \log (N_c + k) \quad (5)$$

$$(T_b,K)^{1/2} = b + m \log M \quad (6)$$

In equation (5), k is used to achieve proportionality with molecular weight: k is zero for hydrocarbons; one for alcohols, ethers, and amines; two for carboxylic acids, esters, and monosulfur compounds; and four for compounds having two sulfurs. For some homologous series, k values (small whole numbers), better than those suggested previously, can be found easily.

Many new boiling points can be estimated by interpolation with the equations in *Tables* 1-7. Extrapolation upward by only one carbon would provide more than 100 additional boiling points.

Equations (1-4) suggest that $(T_b,K)^{1/2}$ is linear with T_c,K,[8] $(T_m,K)^2$, $(\gamma)^2$, and logarithms of entities (e.g., M/d, N_c/N_D, and ΔH_v, $kJmol^{-1}$, 25°C) that are linear

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Table 1—Hydrocarbons. Coefficients for Correlation Equation $(T_b,K)^{1/2} = b + m \text{ Log } N_c$[a-c]

	Carbon Span	Intercept, b	Slope, m	Correlation Coefficient, r	Reference
n-Alkanes	5-33	9.1147	12.055	4,527	11
2-MeAlkanes	6-18	8.5666	12.420	4,674	12
RC_5Hg	6-20	8.9628	12.350	4,764	11
RC_6H_{11}	6-20	9.2699	12.118	3,556	11
Cycloalkanes	5-12	9.0216	12.762	4,724	12
$RCH{:}CH_2$	6-20	8.6951	12.385	4,821	11
RC:CH	6-20	9.2563	11.911	4,544	10
RC_6H_5	8-22	9.2689	12.130	3,896	11
1-$RC_{10}H_7$[d]	14-20	8.8987	12.904	3,738	10
2-$RC_{10}H_7$[d]	13-22	9.5382	12.411	3,728	10

(a) T_b,K, 760 torr.
(b) R is n-alkyl; Me, methyl.
(c) Correlation coefficient (r) of 0.9999527 given as 4,527.
(d) n-Alkyl naphthalenes.

Table 2—Esters. Coefficients for Correlation Equation $(T_b,K)^{1/2} = b + m \log (N_c + k)$[a-e]

	Carbon Span	k	Intercept, b	Slope, m	Correlation Coefficient, r	Reference
RCOOMe	5-15	2	9.6121	11.507	3,576	12
RCOOEt	5-16	2	9.7678	11.225	3,653	12
RCOOPr	6-11	2	9.3437	11.626	3,423	12
RCOOBu	5-22	2	10.908	10.072	3,769	12
RCOOPn	8-13	2	8.3109	12.584	3,129	13
RCOOHx	8-14	2	8.9637	12.028	2,892	13
RCOOHp	11-15	2	9.0322	11.957	2,890	13
RCOOOc	10-16	2	9.2224	11.815	3,659	13
HCOOR	4-9	2	10.179	11.057	3,521	14
HCOOR	4-9	4	6.3429	13.801	3,898	14
MeCOOR	5-12	2	9.7676	11.308	3,840	12
EtCOOR	6-10	2	9.0771	11.950	3,872	14
PrCOOR	6-12	2	9.0618	11.919	3,608	14
BuCOOR	9-13	2	7.9554	12.908	3,093	13
PnCOOR	8-14	2	8.9855	12.003	3,757	13
HxCOOR	9-14	2	9.0816	11.917	3,603	13
HpCOOR	10-16	2	8.9142	12.072	3,772	13
$RCOOCH{:}CH_2$	3-7	2	11.561	9.0401	3,889	15
CH_2:CHCOOR	5-13	4	6.1386	13.809	4,126	16
CH_2:C(Me)COOR	6-12	2	9.0273	11.849	3,686	16
C_6H_5COOR	9-11	2	10.205	11.371	3,356	13
HOCCCOOR	6-11	3	13.601	8.5767	3,806	17
$ROCH_2CH_2COOR$	13-23	3	7.6719	12.915	3,817	18
$MeCOOCH_2CH_2COOR$	7-13	4	11.585	9.7628	3,651	17
R lactates	7-17	3	10.767	10.658	3,781	19
Acetyl lactates	8-17	4	9.6891	11.080	4,068	19
R levulinates	7-12	3	12.251	9.6090	2,885	12,14
Di-Me esters[e]	4-10	6	9.2577	11.615	3,581	20
Di-Et esters[e]	7-14	4	10.377	10.911	3,624	20
Di-Bu esters[e]	10-18	4	10.627	10.604	4,797	20
Di-R carbonates	5-9	3	10.059	10.968	3,726	14
Di-R oxalates	6-10	4	12.112	9.2839	2,865	13
Di-R succinates	8-12	4	11.118	10.226	2,748	14
Di-R sebacates	14-18	4	12.960	8.8699	3,436	14
Di-R Phthalates	10-16	4	15.285	7.1866	2,185	21

(a) T_b,K, 760 torr.
(b) R = n-Alkyl; Et, ethyl; Pr, n-propyl; Bu, n-butyl; Pn, n-pentyl; Hx, n-hexyl; Hp, n-heptyl; and Oc, n-octyl.
(c) Correlation coefficient of 0.999576 given as 3,576.
(d) The k value is usually the number of oxygens.
(e) n-Alkanedioates.

Table 3—Miscellaneous Oxygen Compounds. Coefficients of Correlation Equation $(T_b,K)^{1/2} = b + m \log (N_c + k)$[a-c]

	Carbon Span	k	Intercept, b	Slope, m	Correlation Coefficient, r	Reference
ROMe	4-11	1	9.3966	11.781	**4**,171	22
ROEt	5-10	1	9.1566	11.790	**3**,874	14,22
ROR	6-16	1	8.8561	12.048	**4**,173	12,14
$CH_2(OR)_2$	5-11	2	9.1573	11.689	**4**,407	23
$MeCH_2(OR)_2$	6-12	2	8.6985	11.816	**4**,275	23
$ROCH_2CH_2OR$	6-10	2	9.7649	11.165	**4**,080	21
ROC_6H_5	8-14	1	10.173	11.379	**3**,632	14
RCHO	4-10	1	11.690	9.9124	**3**,764	24
RCOMe	10-17	1	10.385	11.138	**4**,058	12
RCOR	7-15	1	10.163	11.310	**3**,680	12
Cycloketones	4-12	1	12.315	9.9664	**3**,842	25
$ROCH_2CH_2OH$	4-8	4	11.403	9.7341	**2**,840	21
$R(OCH_2CH_2)_2OH$	7-10	3	13.652	8.4527	**3**,855	21
$p\text{-}RC_6H_4OH$	6-10	1	15.129	7.3834	**3**,343	26
ROH	8-20	3	9.2832	11.842	**4**,140	27
RCH(Me)OH	6-12	1	11.706	10.055	**3**,833	12
$HO(CH_2)_xOH$	2-7	2	19.262	4.0346	**3**,150	28
$HO(CH_2)_xOH$	6-12	2	15.943	4.6939	**2**,844	28
RCOOH	6-18	4	11.287	10.530	**3**,438	29,30
$(RCO)_2O$	6-14	3	13.310	7.7262	**5**,200	29,31

(a) T_b,K, 760 torr.
(b) R = n-alkyl.
(c) Correlation coefficient of 0.9999171 given as **4**,171.

with homolog chain length. Equations (7-12) (based on n-alkane data) show this suggestion is valid. Surface tensions are linear with freezing points [equation (13), even n-alkane carbons); this might be inferred from equations (3 and 4).

$$T_c,K = -259.69 + 41.492\,(T_b,K)^{1/2} \quad (7)$$
$(N_c2 - N_c18;\ r = 0.999992;\ T_c,K$, critical temperature[8]

$$(T_f,K)^2 = -152{,}746 + 10036.2\,(T_b,K)^{1/2} \quad (8)$$
$(N_c6 - N_c20;\ r = 0.999859\ T_f,K$, freezing point)[2]

$$(\gamma_{20})^2 = -1057.9 + 76.905\,(T_b,K)^{1/2} \quad (9)$$
$(N_c8 - N_c18;\ r = 0.999655;\ \gamma_{20}$, surface tension)[9]

$$Log\,(M/d_4^{20}) = 0.83270 + 0.069087\,(T_b,K)^{1/2} \quad (10)$$
$(N_c6 - N_c20;\ r = 0.999632;\ d_4^{20}$, density[10]

$$Log\,(N_c/N_D^{20} = -0.11439 + 0.071058\,(T_b,K)^{1/2} \quad (11)$$
$(N_c6 - N_c20;\ r = 0.999778;\ N_D^{20}$, refractivity[10]

$$Log\,\Delta H_v = 0.034758 + 0.079224\,(T_b,K)^{1/2} \quad (12)$$
$(N_c6 - N_c20;\ r = 0.999992;\ \Delta H_v$, heat of vaporization[11]

$$\gamma_{20} = 4.4064 + 0.079655\,T_f,K \quad (13)$$
$(N_c6 - N_c20;\ r = 0.999663)$

Table 4—Nitrogen and Sulfur Compounds. Coefficients of Correlation Equation $(T_b,K)^{1/2} = b + m \log (N_c + k)$[a-c]

	Carbon Span	k	Intercept, b	Slope, m	Correlation Coefficient, r	Reference
RNH_2	8-40	0.0	11.939	10.343	**4**,488	32
R_2NH	8-40	0.0	11.059	10.780	**3**,835	32
$RN(Me)_2$	14-40	0.0	11.070	10.739	**3**,702	32
R_3N	12-60	0.0	11.331	9.9614	**4**,344	12,32
R_3N	9-24	0.0	10.534	10.671	**8**,000	12
$(CH_2)_x(NH_2)_2$	4-8	2	14.037	8.6383	**3**,209	28
RCN	8-20	1	11.935	10.370	**3**,805	32
RNO_2	3-6	5	10.446	10.691	**3**,806	20
RSH	6-20	2	10.373	11.366	**4**,889	11
RCH(Me)OH	6-20	2	9.3730	12.087	**4**,649	10
RSMe	6-20	2	9.1702	12.491	**4**,544	10
RSR	4-14	2	10.350	11.213	**3**,650	14,31
RSR	4-14	4	6.8232	13.607	**4**,866	14,31
RSSR	6-20	4	10.786	10.832	**3**,867	11
$HS(CH_2)_xSH$	2-12	4	13.398	9.1400	**3**,653	33

(a) T_b,K, 760 torr.
(b) R = n-alkyl.
(c) Correlation coefficient of 0.9999488 given as **4**,488.

Table 5—Halogen Compounds. Coefficients of Correlation Equations[a-e]

	Carbon Span	k	Intercept, b	Slope, m	Correlation Coefficient, r	Reference
RF	6-40[a]	0.0	10.616	10.854	4,319	32
RCl	8-40[a]	0.0	12.028	10.278	4,580	32
RBr	8-40[a]	0.0	12.718	9.9626	4,284	32
RI	10-40[a]	0.0	13.360	9.7837	4,675	32
RI	5-10[a]	0.0	15.055	8.0767	3,190	32
$RCHF_2$	3-10[a]	2	8.3100	12.072	4,495	32
$RCHCl_2$	2-10[a]	5	6.3524	13.987	4,543	32
$RCHBr_2$	3-10[a]	11	−1.0105	18.524	4,085	32
RCOCl	4-10[a]	3	9.5361	11.634	4,662	13
$RCHF_2$	3-10[b]	0.0	−8.3360	13.192	4,654	32
$RCHCl_2$	2-10[b]	0.0	−9.8801	14.059	4,523	32
$RCHBr_2$	3-10[b]	0.0	−23.467	18.953	3,895	32

(a) $(T_b,K)^{1/2} = b + m \log (N_c + k)$.
(b) $(T_b,K)^{1/2} = b + m \log M$.
(c) T_b,K, 760 torr.
(d) R = n-alkyl.
(e) Correlation coefficient of 0.9999319 given at 4,319.

Table 6—Organometallics. Coefficients of Correlation Equations[a-e]

	Carbon Span	k	Intercept, b	Slope, m	Correlation Coefficient, r	Reference
$(RO)_3B$	6-12[a]	2	10.069	10.791	3,885	14
$(RO)_3B$	6-12[b]	0.0	−8.9238	13.282	6,500	14
R_4Ge	4-12[a]	−2	15.850	6.4974	3,887	12
R_4Ge	8-20[a]	4	8.0983	11.892	3,896	34
$(RO)_4Si$	8-16[a]	0.0	14.036	7.6676	4,759	12
$(RO)_4Si$	8-16[b]	0.0	−7.6749	12.359	3,074	12
R_4Si	8-20[a]	10	−0.19165	16.580	3,833	35
R_4Sn	4-12[a]	−2	17.164	5.1982	3,838	12
R_3 Phosphates	6-12[a]	20	−2.8770	17.653	3,614	14
R_3 Phosphates	6-12[b]	0.0	0.32089	9.6311	2,863	14
$RSi(Me)_3$	7-17[a]	0.0	10.302	11.082	3,856	14
$RSi(Et)_3$	7-16[a]	0.0	11.138	10.470	3,655	14
Poly Me Siloxanes	6-18[a]	0.0	11.343	10.249	3,812	12
Poly Et Siloxanes	12-24[a]	0.0	12.730	9.0080	5,590	12
Poly Et Siloxanes	12-24[b]	0.0	4.0237	7.7023	4,671	12

(a) $(T_b,K)^{1/2} = b + m \log (N_c + k)$.
(b) $(T_b,K)^{1/2} = b + m \log M$.
(c) T_bK, 760 torr.
(d) R = n-alkyl.
(e) Correlation coefficient of 0.999885 given as 3,885.

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Table 7—Miscellaneous. Coefficients of Correlation Equations[a-e]

	Pressure, Torr	Carbon Span	k	Intercept, b	Slope, m	Correlation Coefficient, r	Reference
n-Alkanes	10	8-40[a]	0.0	6.7933	11.416	**4**,234	11
RCOOMe	1	7-19[a]	2	6.1997	10.989	**3**,843	36
RCOOMe	10	7-19[a]	2	6.8928	11.334	**3**,663	37
RCOOEt	2	8-18[a]	2	5.9590	11.356	**3**,816	36
RCOOPr	10	11-19[a]	2	5.6398	12.271	**3**,605	37
RCOOi-Pr	10	11-19[a]	2	5.6072	12.171	**4**,139	37
MeCOOR	2	8-20[a]	2	6.3549	11.083	**4**,390	36
Triglycerides	0.05	21-51[a]	6	3.9219	11.392	**3**,749	38
Triglycerides	0.001	15-51[a]	6	3.0256	11.166	**3**,663	38
RCOOH	1	8-18[a]	2	11.052	7.9106	**3**,548	38
$(CH_2)_n(COOH)_2$	15	6-10[a]	4	17.970	4.1454	**2**,880	28
$(RO)_3B$	10	12-36[a]	3	7.1752	10.461	**4**,304	39
R_4Sn	10	16-28[a]	4	6.6770	10.584	**3**,533	14
R_4Sn	10	16-28[b]	0.0	−11.522	12.587	**3**,551	14

(a) $(T_b,K)^{1/2} = b + m \log (N_c + k)$.
(b) $(T_b,K)^{1/2} = b + m \log M$.
(c) T_b,K at various pressures.
(d) R = n-alkyl.
(e) Correlation coefficient of 0.9999234 given as **4**,234.

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Automotive Coatings
Bruce N. McBane

Coatings Film Defects
Percy E. Pierce and Clifford K. Schoff

Application of Paint and Coatings
Sidney B. Levinson

Organic Pigments
Peter A. Lewis

Inorganic Primer Pigments
Alan Smith

Marine Coatings
Henry R. Bleile and Stephen D. Rodgers

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A.K. Chattopadhyay and Mark R. Zentner

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Z.W. Wicks, Jr.

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J.W. Prane

Solvents
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P.E. Pierce & C.K. Schoff

Application of Paint and Ctgs.
S.B. Levinson

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Marine Coatings
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J.R. Costanza, A.P. Silveri & J. Vona

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J.E. Gaske

Corrosion Protection by Ctgs.
Z.W. Wicks, Jr.

Mechanical Properties of Ctgs.
L.W. Hill

Automotive Coatings
B.N. McBane

Introduction to Ctgs. Technology
A.H. Brandau

Cationic Radiation Curing
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Society Meetings

BIRMINGHAM ..... MAY

Officer Elections

Club Officers for the year 1991-92 were introduced to the membership as follows: President—R. McDowell Barrett, of B.I.P. Chemicals Ltd.; President-Elect—D.A.A. Wallington, of Ferro Drynamels Ltd.; Honorary Secretary—David C. Morris, of PPG Industries (UK) Ltd.; Honorary Treasurer—Bernard E. Myatt, of Worrall's Powders Ltd.; Meetings Secretary—P. Hassall, of Newtown Industrial Paints Ltd.; and Technical Committee Chairman—Roland L. Staples, of CWS Coatings Technology.

Club members who will serve on the Executive Committee are: M.J. Wright, of Carrs Paints Ltd.; G.W. Jenkins, of Intercoat Ltd.; and Susan Roy, of BASF Coatings & Inks Ltd.

Immediate Past-President Graham C. Miles, of PPG Industries (UK) Ltd., presented Mr. Barrett with the Presidential Chain of Office.

Mr. Barrett presented Mr. Miles with his Past-President's Badge and congratulated him for his efforts while serving as a Club Officer.

Mr. Staples announced that the Technical Committee will sponsor a symposium to be held February 6, 1992. Further details of the symposium will be released at a later date.

DAVID C. MORRIS, *Secretary*

GOLDEN GATE ..... APR.

"Pigmented Coatings Problems"

The membership approved the nomination of Dennis R. Owen, of Technical Coatings Company, to fill the unexpired term of Society Secretary for 1990-91.

Tom Kam, of the Redwood City Library, was presented with a plaque in appreciation of his many years of service at the library in connection with the paint technology collection.

New York Society member Elio Cohen, of Daniel Products Company, gave the meeting's technical presentation. Mr. Cohen's topic was "PIGMENTED COATINGS PROBLEMS AND SOLUTIONS ASSOCIATED WITH PARTICLE SIZE."

The speaker explained that many new vehicles have been developed to comply with environmental regulations and the demand for higher performance. He stated that pigments have been developed for better exterior durability and ease of dispersion. Also, milling equipment has been upgraded.

Mr. Cohen said additives have been developed to help overcome wetting and dispersion problems caused by new vehicles, pigments, and processes.

The speaker emphasized that some dispersion problems are not created by the new developments. He explained that careful observation is needed to determine whether proper dispersion has yet to be achieved (too coarse) or has been surpassed (too fine).

In conclusion, Mr. Cohen said stability, color, durability, and cost are some of the important reasons for striving for proper dispersion.

DENNIS R. OWEN, *Secretary*

KANSAS CITY ..... MAY

"Environmental Concerns"

The following members have been nominated to serve as Society Officers for 1991-92: President—Craig Hughes, of Farmland Industries, Inc.; Vice President—H. Jeff Laurent, of F.R. Hall, Inc.; Secretary—Yvonne D'Arcy, of Cook Paint & Varnish Company; and Treasurer—Lawrence J. Murphy, of Tnemec Company, Inc.

The evening's speaker was Catherine Lippert, of the Sierra Club. Ms. Lippert's presentation focused on "ENVIRONMENTAL CONCERNS: A GRASS-ROOTS PERSPECTIVE."

The speaker's focus was on the Sierra Club's concerns regarding oil drilling in the Arctic, energy issues, and overpopulation. A slide presentation was used to illustrate the Club's concerns.

The main topic of Ms. Lippert's program was the protection of the Arctic National Wildlife Refuge from oil exploration. In the 1950s, President Eisenhower's administration set aside eight million acres in northeast Alaska for protection. In 1980, the region was expanded to 18 million acres. The speaker explained that the area was given "wilderness protection," which sheltered it from oil and gas exploration. However, due to intense lobbying by oil companies, a 125-mile tract of land encompassing 1.5 million acres along Alaska's northern coastline remained unprotected. She stated that oil companies are attempting to conduct oil exploration in this area, despite a 1987 Department of the Interior study.

In summation, the study concluded the following: there is only a 20% chance that oil will be discovered in this coastal plain; there is only a 1% chance that any oil found in this area would be on the scale of oil found in nearby Prudhoe Bay; if oil is found, it will supply only 1.8% of the world's oil needs over the expected 25-year life span of this reserve; and, the coastal plain is the biological heart of the wildlife refuge, which would be affected adversely if oil and gas exploration are allowed to be developed.

Ms. Lippert said that oil drilling in the Arctic is extremely expensive. She also called attention to the fact that other than this 125-mile stretch of coastline, the entire 1,100 miles of northern Alaskan coastline has been made available for oil and gas exploration or has already been drilled. The speaker stated that the Department of the Interior has recommended that this coastal plain be opened for gas and oil exploration.

Ms. Lippert discussed some of the concerns which are being ignored by the oil companies in their efforts to drill in this region and the physical damage which would be incurred by the coastal plain during drilling.

The speaker then expanded her focus to include the energy issue. She stated much of what occurs in the coastal plain of northern Alaska will be determined by energy strategy developed by the U.S. Government. Ms. Lippert discussed President Bush's recent energy plan and his energy strategy.

The final segment of the speaker's talk concerned overpopulation. She stated that overpopulation is creating many problems, including: destroying rain forests for cropland; increasing garbage and pollution; killing 40,000 children every day due to famine; and causing species to become extinct.

CRAIG HUGHES, *Secretary*

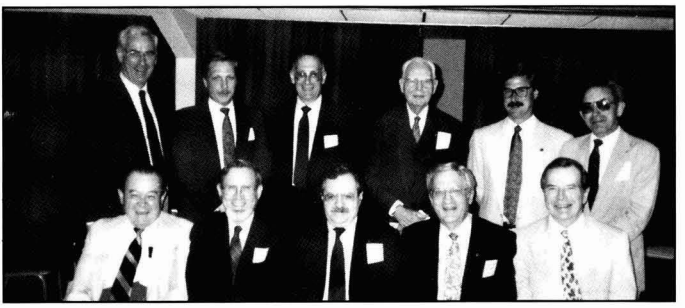
NEW ENGLAND ..... MAR.

"Color Matching"

John O'Brien, of Colorgen Corporation, spoke to the members about "LOW-COST COLOR MATCHING—WHAT IT HAS DONE FOR THE COATINGS INDUSTRY, AND WHERE IT IS GOING IN THE FUTURE."

Mr. O'Brien began his presentation by stating that color matching systems are being used extensively at the consumer level, as well as at the traditional coatings manufacturer level. He explained that the coatings industry has pioneered the use of color computers and introduced the technology to the general public.

According to the speaker, the three necessities for this new market are: low cost, complete technical service, and user friendly systems. He said the only way to meet all



PITTSBURGH SOCIETY PAST-PRESIDENTS—Celebrating Past-Presidents' Night at the Pittsburgh Society May meeting are (l-r): seated—Gerry Ward, Clifford Schoff, Carl Izzo, Kenneth E. Luyk, and Ray Uhlig; standing—Michael Gillen, James E. Lore, Joseph L. Mascia, Hiram P. Ball, Anthony J. Isacco, and William Spangenberg

three criteria is to market the color computer as a stand-alone computer, as opposed to a computer system with many functions.

Mr. O'Brien estimated that the paint and coatings retail market is currently at 25% penetration. With the rising trend of retail (chain) stores, he predicted a 50% market penetration by 1996.

In conclusion, Mr. O'Brien said that color matching will expand from a paint matching system to a complete decorating tool. He credited the coatings industry for pioneering the use of the computer as a retail shopper decision-making assistant.

Q. What percentage of paint sold through stores is matched?

A. Approximately 40% of chain stores sales is matched. The remainder of stores will vary depending on many regional characteristics.

Q. How do you handle a customer who brings in a cloth which is flat and they want to purchase a high gloss enamel?

A. In going from flat to a high gloss, the difference in gloss or texture does not cause a problem. The difficulty is in matching from a high gloss to a flat. We have a specular included and a specular excluded on our systems to deal with gloss variation. The specular would exclude the gloss factor to convert from a glossy sample to a flat paint.

To the customer, it will sometimes appear different (even when the match is there). Since cloth is generally dyed, that example would present the additional difficulty of matching a pigment to a dye. These complications would end up yielding an estimated match rather than an exact match; however, this approximation would still be of value to the individual conducting the match.

JOHN LUKENS, *Secretary*

PHILADELPHIA .....MAR.

"Waterborne Epoxies"

The meeting's speaker was Louisville Society member Michael A. Jackson, of Rhone-Poulenc, Inc. Mr. Jackson's topic was "PERFORMANCE ENHANCEMENT OF WATERBORNE EPOXIES UTILIZING THE EPOXY TO AMINE RATIO."

The speaker stated the epoxy to amine ratio was a key in the successful development of high performance two-component waterborne systems. He said waterborne technology relies on two epoxy types, both based on Bisphenol A (weight per epoxide of 190 and 500).

According to Mr. Jackson, the performance properties of waterborne epoxies are a direct function of the curing agent. The curing agents, typically amines, may be in the form of amine adducts, amido-amines, polyamides, and cycloaliphatic amines. He explained that the particular performance characteristics of the two-component systems vary with the compositional variations possible within the curing agent (changes in molecular weight or reactive groups). The speaker stated that a variety of individual performance criteria can be altered by changing the curing agent, in effect, producing a coating designed for a specific use. More versatile coating systems also can be achieved by combining the properties of several curing agents.

Mr. Jackson stated that the use of several curing agents leads to more raw material inventory. He suggested that a better formulating strategy would be to choose one or two specific curing agents and to develop the variety of properties through variation of the epoxy to amine ratio.

The speaker presented a brief overview of resin stiochiometry, essentially the ratio of epoxy to amine on an equivalent weight basis. He explained that by using this basic concept, a formulator can vary the stiochiometric ratio to obtain almost any particular property desired. Mr. Jackson presented an experimental design using various stiochiometrics.

Q. What type of coalescing solvents are used?

A. The solvents of choice are glycol ethers alone or in combination with alcohols. Some aromatics may be used, not as coalescents, but more as thickeners due to resin particle swelling.

Q. What size is the particle in the epoxy dispersion?

A. The particle size is 0.5 micron.

WILLIAM J. FABINY, *Secretary*

PHILADELPHIA .....APR.

Awards Night

The Nominating Committee submitted the list of Society Officers for 1991-92: President—Peter C. Kuzma, of VIP Products Corporation; Vice President—William J. Fabiny, of Sermagard Coatings; Secretary—Brian O'Connor, of McWhorter Resins, Inc.; Treasurer—Robert D. Thomas, of M.A. Bruder & Sons, Inc.; Assistant Treasurer—Barrett C. Fisher, of Van Horn, Metz & Company, Inc.; Senior Member-at-Large—Howard J. Salmon, of Clement "Coverall" Company; and Junior Member-at-Large—Thomas G. Brown, of Consultants Consortium.

The prestigious Liberty Bell Award was presented to Society Secretary William J. Fabiny. The award is presented to an individual who has provided "outstanding contributions to the advancement of the protective coatings industry and to the Philadelphia Society."

Lawrence J. Kelly, of Eastech Chemicals, presented the Eastech Past-President's Award to Orville E. Brown, of M.A. Bruder & Sons, Inc.

A 50-Year Pin was presented to Erle F. Krauss, retired.

Seven Society members received their 25-Year Pins: William J. Allsopp II, of Rheox, Inc.; A. Charles DuBree, of McAdoo & Allen, Inc.; Donald B. Jones, retired; Maurice J. McDowell, retired; Marvin Mick, of Northeast Paint & Varnish Company; Edward Rabon, retired; and John G. Weinmann, retired.

Technical Committee Chairman Julio J. Aviles, of Kronos, Inc., announced that this year's recipient of the "Ozzie" Award was

Henkel Corporation. The award is presented to the company which hosts the Technical Committee plant tour.

WILLIAM J. FABINY, *Secretary*

PIEDMONT ..... MAY

"Steel Drum Disposal"

Dale A. Baker, of Kohl Marketing, Inc., was nominated to serve as Society Treasurer for 1991-92.

The meeting's speaker was Society member Edward C. West, of General Steel Drum, Chairman of the Steel Shipping Container Institute (SSCI). Mr. West presented a talk on "STEEL DRUM DISPOSAL; DRUM RECONDITIONING AND RECYCLING."

The speaker used a slide presentation to illustrate the state-of-the-art processes used in drum recycling. He discussed the safety record for shipping in steel containers, including strength, stackability, weatherability, durability, and fire resistance for almost 100 years. However, Mr. West explained that the industry is facing more stringent regulations for shipping materials due to environmental concerns.

The speaker said the SSCI is on the cutting edge of technology with the programs which it has implemented to recycle container steel. Mr. West outlined a closed-loop recycling system designed to result in 100% reclamation of steel drums and pails. Also, he presented "a year in the life of a steel drum." The speaker reported that the steel industry is at the present recycling at a 66% rate.

In conclusion, Mr. West stated that the SSCI is striving to achieve the maximum in waste minimization. One challenge which remains is in the standardization of steel drums so that they are more easily reconditioned.

ANNETTE SAUNDERS, *Secretary*

PITTSBURGH ..... MAY

Past-Presidents' Night

A moment of silence was observed in memory of Edward L. Brazet, Society Past-President (1972-73), who died recently.

In attendance were 10 Society Past-Presidents, including: Hiram P. Ball (1945-46), Federation Past-President and Honorary Member; Gerry Ward (1962-63), retired; Kenneth E. Luyk (1968-69); Carl Izzo (1969-70), of Westinghouse STC; William Spangenberg (1976-77), of Hammond Lead Products Inc.; Ray Uhlig (1980-81), Consultant; Michael Gillen (1983-84), of J.M. Gillen Company; Clifford Schoff (1984-85), of PPG Industries, Inc.; Joseph L. Mascia (1985-86), of Campbell Chemical Company; Anthony J. Isacco (1986-87), of Puritan Paint & Oil Company; and James E. Lore (1989-90), of Watson Standard Company.

The following members were elected to serve as Society Officers for 1991-92: President—Joseph Powell, of Union Carbide; Vice President—Jeffrey Sturm, of Kop-Coat, Inc.; Secretary—Timothy Zeffiro, of J.M. Gillen Company; Treasurer—Mark A. Harley, Jr., of PPG Industries, Inc.; and Society Representative—William Spangenberg.

Ray Uhlig was recognized for his many years of service as Society Representative to the Federation's Board of Directors.

Presented with 25-Year Pins were: William Spangenberg; George Gerhardt, retired; and William E. Shields, of McCann Shields Paint Company.

The meeting's speaker was Jack McCall, of the Valspar Corporation, whose topic was "THE SURPRISING WORLD OF PACKAGING COATINGS."

The speaker discussed the various methods of coating both metal and paper containers. Examples of coated flatstock, finished cans and closures, and two rare beer cans, packaged in 1935 and still containing the original beer, were on display.

JEFFREY C. STURM, *Secretary*

Letters to the Editor

Dear Editor,

As a longtime reader, sometime critic, of the official publication of our Federation, I must compliment you on the article in the March 1991 issue of the JOURNAL OF COATINGS TECHNOLOGY, "Modern Analytical Resources: The Chemist's Ally," a Condensed Summary of the Presentations at a Seminar Presented by the Professional Development Committee, Federation of Societies for Coatings Technology, Los Angeles, CA, May 16-17, 1989. (Vol. 63, No. 794, Pages 19-26.)

The article summarizes, via a variety of practical examples, how the modern analytical techniques can assist the coatings technologist to address and resolve complicated coatings problems.

But equally significant, it demonstrates again the usefulness of the rigorous application of the scientific method in solving coatings problems, a reminder we can all use now and then.

I also feel due recognition should be given to the significant contribution of Sidney Lauren, who edited the tapes of the contributing analytical experts and provided us with a concise, clear, and graceful text. It's another example of why this man's technical competence and language skills are so highly valued by his colleagues.

Minimizing hyperbole, I simply submit that this article might well constitute the best eight pages ever published in the JCT, Mattiello Lectures excepted.

Respectfully,
John J. Oates
Member, New York Society

Elections

CDIC

Active

MacDougall, Paul B.—Yenkin Majestic Paint, Columbus, OH.
Miller, Thomas H.—Talsol Corp., Cincinnati, OH.

Associate

Handleton, Robert T.—Henkel Corp., Cincinnati, OH.
Kallal, David A.—Hüls America Inc., Strongsville, OH.
Kelley, Jerry L.—Byk-Chemie USA, Louisville, KY.

CHICAGO

Active

Carncross, Charles E.—Buckman Laboratories, Algonquin, IL.

GOLDEN GATE

Active

Cappelli, Philip A.—Hüls America Inc., Pleasanton, CA.
Joe, Cynthia J.—GSA Laboratory, San Francisco, CA.
Lis, Annmarie—Sherwin-Williams Co., Emeryville, CA.
Sheridan, Paula R.—Hüls America Inc., Pleasanton.
Urnezis, Matthew A.—GSA Laboratory, Concord, CA.

Associate

Esslinger, Pete—Aqualon Co., Westminster, CA.
Krinsky, Peter R.—SCM Chemicals, Santa Fe Springs, CA.
O'Neil, Wayne G.—Henkel Corp., Downey, CA.

Educator/Student

Cook, Daniel-Denos C.—Livermore, CA.
Emery, Earl F.—Cal Poly SLO, San Luis Obispo, CA.
Nanna, Michael E.—San Luis Obispo.

NEW YORK

Active

Irizarry, Robert—King Industries Inc., Norwalk, CT.

Associate

Blacker, Roger P.—Jesse S. Young Co., Elizabeth, NJ.
Grunstra, Thomas W.—Whittaker, Clark & Daniels, South Plainfield, NJ.

PACIFIC NORTHWEST

Active

Green, Allan—Chemwest Consulting, North Vancouver, B.C.

PIEDMONT

Active

Erlandson, Paul—Sequa Chemicals, Chester, S.C.
Fuss, Charles D.—Volvo GM Heavy Truck, Dublin, VA.
Kopack, Peter D.—Novachem Corp., High Point, NC.
McDonald, Charles M.—Kewhunee Scientific, Statestville, NC.
Washabaugh, Donald L.—Commonwealth Custom Coatings, Lynchburg, VA.
Wellen, Donald R.—Volvo GM Heavy Truck, Dublin.
Werner, Ronald A.—Akzo Coatings, High Point.

Associate

Archer, Tammy B.—Southchem Inc., Greensboro, NC.
Baker, A. Dale—A.B. Kohl Sales Co., Roswell, GA.
Banks, Donna M.—Reichhold Chemicals, Research Triangle Park, NC.
Biddle, Rodney—Reichhold Chemicals, Research Triangle Park.
Chestnutt, William—Kohl Marketing, Greensboro.
Council, Mary Ann—American Cyanamid, Bridgewater, NJ.
Furano, Joseph—CIBA-GEIGY Corp., Mathews, NC.
Gaglia, Diane M.—Union Carbide, Charlotte, NC.
Hong, Richard K.—Reichhold Chemicals, Research Triangle Park.
Mallory, David M.—Rhone-Poulenc, Kannapolis, NC.
Martin, Paul F.—Reichhold Chemicals, Research Triangle Park.

TORONTO

Active

Jetha, Sultan—Toronto, Ont.
Skelton, C. Peter—Bay Mills Ltd., St. Catherines, Ont.

Associate

Roycroft, John A.—Pigment & Chemical Inc., Milton, Ont.

AFFILIATED

Baez, Francisco—Harris Paints, San Juan, Puerto Rico.
Brown, Dervin R.—Berger Paints Jamaica Ltd., Kingston, Jamaica.
Gangal, Subhash—Saraa Engineers, Maupada, Thane, India.
Magnussen, Steinar Ask—Nor-Bas AS, Drammen, Norway.
Malaga, Early—Quimica Industrial, Lima, Peru.
Tanuprayogi, Harry—CV Mowilex, Kec Cengkareng, Indonesia.
Vasconcellos, Antonio—Pinturas Ecuatoriana, Guayas, Ecuador.
Wong, Derrick B.—The Sherwin-Williams Co., Kingston, Jamaica.

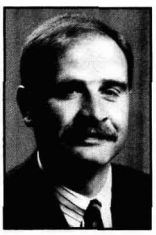
People

Eric Bensaid has accepted the position of Vice President/International Sales with Troy Corporation, Newark, NJ. Mr. Bensaid previously served as President of CDF Chemie North America (Orkem) and founded the U.S. subsidiary after serving as World Export Manager for the Paris-based specialty and intermediate chemicals producer. He also served as EEC and non-EEC Marketing Manager for CDF Chemie Plastics Division.

E. Bensaid

C.E. Davis, Jr.

M. Sullivan



F. Termine

The Packaging Products Division of The Dexter Corporation, Waukegan, IL, has appointed **Charles E. Davis, Jr.** as Director/Strategic Quality Enhancement. Mr. Davis' responsibilities will include planning and directing a strategic quality enhancement program designed to increase individual productivity; and training employees in team building, coaching, project team concepts, and the culture of strategic quality enhancement. He will also guide top management in all quality-related concerns.

In addition, 17-year Dexter employee, **Alice B. Greene**, has accepted the newly created position of Manager of Communications. At this post, Mrs. Greene will be responsible for coordinating the division's global advertising and sales promotion, developing of a division identity program, managing marketing and corporate publicity and press relations, planning and coordinating all internal publications, and special communications projects.

National Chemical Company, Chicago, IL, has announced the appointment of **Michael Quinn** to the position of National Sales Manager. In this position, Mr. Quinn will oversee the sales force that handles catalysts, anticorrosive pigments, UV coatings, and overprint coatings.

The Dow Chemical Company, Midland, MI, has appointed **Mark Sullivan**, Market Manager/Powder Coatings Resins at Dow Plastics. Mr. Sullivan began his career at Dow in 1983 in the company's market development program. He then moved to Dow's Rochester, NY sales office, where he worked for four years as a Field Seller. In 1989, Mr. Sullivan was named Market Manager for molded elastomer products. He has served as Manager of Distribution for the Thermoset Applications Group and most recently as Product Manager/Epoxy Resins.

Anothony J. Poole, Sr. has been named Vice President, LCI Fiberglass Products Division, of Inland Leidy, Inc., Baltimore, MD. Mr. Poole brings over 25 years of experience in the fiberglass reinforced plastics industry to this position. He most recently served as Business Manager/Fiberglass Products Division.

In addition, **Linda P. Morris** has accepted the position of Business Manager for the division. Ms. Morris will continue in her previous post as Technical Sales Representative in addition to assuming her new responsibilities as Business Manager.

The promotion of **Frank Termine** to the newly created position of Assistant Vice President/Corporate Environmental Marketing has been announced by Betz Laboratories, Inc., Trevose, PA. Since joining Betz in 1976, Mr. Termine has held a number of engineering/management positions within the company. Most recently, he served as Director of Technical Marketing for Betz Industrial.

In addition, Betz MetChem, Horsham, PA, a division of Betz Laboratories, Inc., has announced the following executive promotions:

Leonard R. Wall has been elected President of Betz MetChem. He had been Executive Vice President and General Manager since the division was formed in January 1988.

The position of Vice President of Finance has been accepted by **David L. Chester**. His responsibilities include accounting, customer service, office services, and human resources.

M. Raymond Matuza has been named Vice President of Sales. He will be responsible for the development of marketing sales plans to support the field sales force.

Carmen V. Sarno has been appointed Vice President of Technical Marketing in charge of product management, engineering support, and marketing communications.

Reimund Pieter has been named Market Development Manager within the New Products Division of Degussa Corporation's Chemical Group, Ridgefield Park, NJ. In this new position, Dr. Pieter will be responsible for sales and marketing of a wide variety of fine and specialty chemicals and organic intermediates. Prior to joining Degussa in the United States, he had been a Chemist for the past five years at Degussa AG's Applied Technology Department in Wolfgang, Germany.

The Chemicals Coaters Association International (formerly Chemical Coaters Association), Cincinnati, OH, recently announced the 1991-92 National Officers and Board of Directors.

Rex Winemiller, of Dove Equipment, is the newly appointed President. **John Baller**, of Unitech, will assume the post of Vice President, and **Jim Malloy**, of Kolene Corporation, has been named Secretary/Treasurer.

Re-elected to the National Board of Directors are: **Art Godding**, of Heatbath Corporation; **Jim Malloy**; and **Bob New**, of Broan Manufacturing. Newly appointed to the Board are: **George Bryant**, of Briggs & Stratton; and **Rodger Talbert**, of Rapid Engineering.

Continuing on the Board of Directors are: **William Baldwin**, of Evtech; **Mr. Ballar**; **Bruce Bryan**, of Gema Volstatic; **Michael Fisher**, of Moline Paint; **Lawrence Melgary**, of Northern Coatings & Chemicals; **Mr. New**; **Geoffrey Souter**, of Guardsman Products; **Bob Warren**, of Novamax Technologies; **Rex Winemiller**; and **John Zieche**, of River Valley Coatings Inc.

John W. Johnstone, Jr., of Olin Corporation, was elected Chairman of the Board of the Chemical Manufacturers Association (CMA) at the group's Annual Meeting. He succeeds **H. Eugene McBrayer**, of Exxon Chemical Company.

J. Roger Hirl, of Occidental Chemical Corporation, was elected Vice Chairman of the Board. **Frank P. Popoff**, of The Dow Chemical Company, was elected Chairman of the Executive Committee.

Robert A. Roland was re-elected President of the Association.

Newly elected or re-elected to the Board of Directors were: **Craig R. Andersson**, of Aristech Chemical Corporation; **John D. Burns**, of Vista Chemical Company; **Vincent A. Calarco**, of Crompton & Knowles Corporation; **Albert J. Costello**, of American Cyanamid Company; **Earnest W. Deavenport, Jr.**, of Eastman Chemical Company; **Ernest H. Drew**, of Hoechst Celanese Corporation; **James E. Fligg**, of Amoco Chemical Company; **Thomas L. Gossage**, of Hercules Incorporated; **Michael H. Grasley**, of Shell Chemical Company; **Earl H. Harbison, Jr.**, of Monsanto Company; **Glen H. Hiner**, of GE Plastics; **Alan R. Hirsig**, of ARCO Chemical Company; **W. Loy Johnson**, of Kerr-McGee Chemical Corporation; and **H. William Lichtenberger**, of Union Carbide.

Also named to the Board were: **Philip W. Matos**, of Mobil Chemical Company; **Thomas R. Mitchell**, of Reichhold Chemicals, Inc.; **Ray B. Nesbitt**, of Exxon Chemical Company; **John E. Peppercorn**, of Chevron Chemical Company; **Larry V. Rankin**, of Betz Laboratories, Inc.; **Lawrence A. Reed**, of Dow Corning Corporation; **Jerry R. Satrum**, of Georgia Gulf Corporation; **Frank P. Smith**, of The Procter & Gamble Company; **William R. Toller**, of Witco Corporation; **George A. Vincent**, of The C.P. Hall Company; **Harald P. Wulff**, of Henkel Corporation; and **Jochen C. Wulff**, of Mobay Corporation.

In other association news, **W.H. Clark, Jr.**, of Nalco Chemical Company, has been named to head the chemical industry's coalition on foreign trade. Mr. Clark is a former member of the CMA Board of Directors and succeeds **Dexter F. Baker**, of Air Products and Chemicals, Inc., as trade advisor of the industry group.

Vahe Karayan, who served as Technical Services Manager for Avecor, Inc.'s San Fernando, CA, plant since June 1990, has been promoted to Corporate Technical Director and transferred to the firm's Vonore, TN, headquarters. He is responsible for a broad range of technical services, including company-wide compliance with environmental regulations and occupational safety and health issues.

Also, **Craig Dunaway**, with over 14-years experience in polymer manufacture, quality control, and sales, has joined Avecor as Sales Representative. Mr. Dunaway will be responsible for sales coverage in Michigan, northern Indiana, and western Ohio. He will be based in Granger, IN.

Ivan Skala and **Ellen Jean Friedla** have joined Witco Corporation's International Marketing Department as Technical Sales Representatives, providing sales and technical support to Witco's network of distributors and sales agents worldwide. Mr. Skala joins the company from C-Impex/New Brook International. Ms. Friedla previously was a Chemist with General Electric Silicones before joining Witco.

In addition, **Mark P. Durham** has joined the staff of Witco as Assistant Manager of the Public Relations Department. His primary duties will include internal communications and support for Witco's community, financial, and media relations efforts.

James E. Dickers, Vice President and General Manager/Coatings, Inks, and Resins Buisness Organization, of Eastman Chemical Company, Kingsport, TN, has announced several new appointments within the organization.

The appointments include: **James J. Barbarito**—Business Manager/Resin Intermediates; **William T. Sade**—Market Manager/Resin Intermediates; **Eric DeLoach**—Business Manager/Coatings; **Stephen N. Belote**—Market Manager/Coatings; **Matt J. Russ**, Buisness Manager/Inks and Pigments; **David S. Oaks**—Market Manager/Inks and Pigments; **Francois Vleugels**—Market Manager/Europe, Middle East, and Africa; **Larry A. Munsey**—Manager/Business Development, Coatings, Inks, and Resins; **Stanley W. Polichnowski**—Manager of Technology; and **James T. Wallin**—Manager of Administration.

Harold R. Penton has been promoted to Director of Ethyl S.A.'s new European research and development center in Louvain-la-Neuve, Belgium. Based in Brussels, Ethyl S.A. is a subsidiary of Ethyl Corporation, Richmond, VA. Mr. Penton joined Ethyl in 1977 as a Research Chemist following four years as a Senior Research Chemist and Group Leader with Akzo Chemicals in the United States and The Netherlands.

Charles E. Dellerman has joined the staff of Flanagan Associates Inc., in the capacity of Account Supervisor. Mr. Dellerman brings experience in product and process knowledge to this position. He previously served as Production Manager/Container Coatings Division for BASF Corporation. Mr. Dellerman will operate out of Flanagan Associates' main offices in Cincinnati, OH.

Rohm Tech, Inc., Fitchburg, MA, has appointed **John T. Kolackovsky** to the position of Business Manager/Polymers Division, where he will be responsible for the sales, marketing, and operations of that division. Mr. Kolackovsky most recently served as Manufacturing Manager.

Henri Verhaegen, Du Pont Chemicals Senior Account Manager in Safety and Environmental Resources, is the recipient of a 1990-91 Corporate Marketing Excellence Award. Mr. Verhaegen received this award for his marketing efforts in the United Kingdom, including selling safety services to industry, government agencies, and the British and French consortium building the tunnel under the English Channel. Mr. Verhaegen began his career with Du Pont 25 years ago at the coatings research and development laboratory in Belgium.

In other Du Pont news, the following personnel changes were announced: **R. Kent Farris**—Market Planner/White Pigments Mineral Products, Wilmington, DE; **John E. Imes**—Account Manager/Coatings and Plastics (Central), Columbus, OH; **Stephen J. Leung**—Sales Representative/Coatings and Plastics (Central), Detroit, MI; **Patrick B. Lutz**—Account Executive/Coatings and Plastics (West); **David R. Appel**—Senior Account Manager/Coatings and Plastics (East), Pittsburgh, PA; and **Samuel O. Taylor**—Senior Account Manager/Coatings and Plastics (West).

Mr. Farris is a member of the CDIC Society; Mr. Lutz is a member of the Pittsburgh Society; and Mr. Taylor is a member of the Golden Gate and Pacific Northwest Societies.

Membership Anniversaries

50-Year Members

Chicago Society

CLIFFORD O. SCHWAHN—Retired

New York Society

C.A. ALOIA—Retired
RUBIN CHALEFF—Retired

Philadelphia Society

ERLE F. KRAUSS—M.A. Bruder & Sons, Inc.

UM-Rolla Announces Fall Short Course Schedule; Focus on Compositon of Coatings and Paint Formulation

The Coatings and Polymer Science Program, of the Department of Chemistry, University of Missouri-Rolla (UMR), Rolla, MO, has announced that two short courses will be conducted in the fall.

The introductory courses include: "The Basic Composition of Coatings"—September 9-13; and "Paint Formulation"—October 21-25. Both courses will be held at the UMR campus in Rolla.

The class on "Composition of Coatings" is designed to introduce the newcomer, as well as those involved in raw material manufacture, sales, and technical service, to the technical aspects of paint composition, manufacture, testing, and use. Topics of discussion will include: history of paint; materials used in manufacture; simple formulating techniques that can be put to immediate use; an introduction to the equipment used to make and test modern protective coatings, and modern chemical instrumentation applied to coatings; and simple costing that allows beginners to start on a stable economic basis.

Also scheduled to be included as part of the "Composition of Coatings" short course will be a plant tour of a paint company in St. Louis, MO.

University Extension
UNIVERSITY OF MISSOURI
ROLLA

"Paint Formulation" will feature five intensive days of study and work in a laboratory. The class will offer the opportunity to study and experiment with: basic raw materials and their influences on the performance of the finished coating; formulation and testing of coatings in the laboratory to meet the special demands of the job; limitations of plant production equipment and formulation variables for moving a coating from the lab to the plant; modern chemical instrumentation as applied to coatings; and statistical experimental design.

Prerequisites for the course include: experience in a coatings laboratory or raw materials and manufacturing company; or, completion of the UMR introductory short course on "The Basic Composition of Coatings"; or, some basic training in chemistry.

Continuing Education Units will be awarded for successful completion of each short course.

For more information about course content, contact: Dr. Michael Van De Mark, Director, Coatings and Polymer Science, UMR, Rolla, MO 65401-0249.

To register, contact: Norma R. Fleming, Continuing Education Coordinator, at the previously listed address.

VOC Training Course Slated for Fall, in Toronto

ASTM, Philadelphia, PA, will be sponsoring the course, "Paint Volatile Organic Compounds (VOC)," in Toronto, Ont., Canada, on November 7-8, 1991.

The two-day Standards Technology Training course will include laboratory demonstrations of gas chromatography, the Karl Fischer method, and others. All demonstrations will take place at the Technical Service Laboratory in Mississauga, Ont., Canada.

Also, the basic principles of the ASTM test methods used to measure VOC under Reference Method 24 in the U.S. Environmental Protection Agency (EPA) New Source Performance Standard will be covered.

The class is designed for chemists and others who use U.S. EPA tests to determine if paints or coatings meet VOC requirements.

The deadline for registering for the "Paint VOC" course is October 24. For a course brochure and registration information, contact Kathy Dickinson, ASTM, 1916 Race St., Philadelphia, PA 19103.

CALL FOR PAPERS

19th Annual Waterborne, Higher Solids, and Powder Coatings Symposium

Sponsored by

Southern Society for Coatings Technology
and
The University of Southern Mississippi

February 26-28, 1992 • New Orleans, LA

All prospective authors are invited to submit papers for presentation at the 19th Annual Waterborne, Higher-Solids, and Powder Coatings Symposium, sponsored by the Southern Society for Coatings Technology and the Department of Polymer Science at The University of Southern Mississippi, Hattiesburg, MS, on February 26-28, 1992, in New Orleans, LA.

Papers relating to the chemistry, formulation, and marketing of waterborne, higher-solids, powder and other advanced coating systems are solicited. Manuscripts relating to engineering aspects of coating systems or solvent abatement are also welcome.

Title, abstract, and authors' names (speaker's name underlined) should be submitted no later than August 15,1991 to: Dr. Robson F. Storey or Dr. Shelby F. Thames, Co-Organizers, WBHS&PC Symposium, Department of Polymer Science, The University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076.

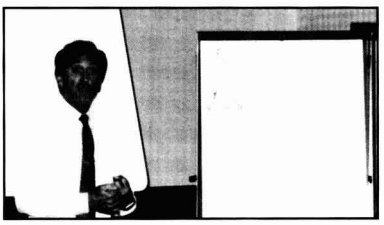
The completed paper should be submitted by December 2, 1991. The preliminary program will be developed based on the submitted abstracts. Manuscripts will be required for inclusion in the Symposium Proceedings. *It is required that all papers be original and of scientific value.*

Dr. Peter Hunt Discusses Employee Motivation At Seminar Cosponsored by Chicago Society

The Joint Educational Committees of the Chicago Society for Coatings Technology and the Chicago Paint & Coatings Association sponsored the seminar "Increasing Productivity through Employee Development and Motivation," at the Oakbrook Marriott, in Oakbrook, IL, on June 5.

The management development seminar was presented by Dr. Peter J. Hunt, of Productivity Management Consultants.

The one-day seminar was divided into two parts: motivating employees and developing employees. Both sessions were designed to increase employee productivity.



MANAGMENT DEVELOPMENT SEMINAR—Dr. Peter J. Hunt discusses employee motivation and development with members of the Chicago Society and Chicago Paint & Coatings Association

The initial segment of the presentation focused on the concept of motivation and provided specific techniques, ideas, and examples for increasing motivation among employees.

The second session incorporated the motivation segment into a performance management system. The system is an employee development process which promotes goal setting (management by objectives), performance assessment and feedback, decentralization, job enrichment, participative management, and an individual output-based reward system—all qualities which significantly contribute to increasing productivity.

SSPC to Conduct Tutorial on Lead Paint Removal

The Steel Structures Painting Council (SSPC), Pittsburgh, PA, will conduct five two-day tutorials in September and October dealing with the environmental and technological aspects of lead paint removal from industrial structures.

The schedule for the tutorial is as follows: September 4-5—Hyatt Regency O'Hare, in Chicago, IL; September 11-12—Radisson Airport Hotel, in Philadelphia, PA; September 23-24—Hyatt Regency Houston, in Houston, TX; September 25-26—Holiday Inn Crown Plaza, in New Orleans, LA; and October 2-3—Boston Park Plaza, in Boston, MA.

The two-day class is designed to impart basic knowledge of lead paint removal technology to facility owners, contractors, and others concerned with the removal of lead-based paint in a safe and environmentally acceptable manner. The tutorial was developed through industry experience with lead removal projects in the last several years and from the research efforts of SSPC, the Federal Highway Administration, and other organizations and agencies.

The tutorial will cover the following topics: environmental regulations; removal and containment techniques; compliance monitoring and assessment; waste testing and disposal; and health and safety.

The class will be presented by: Dr. Lloyd Smith, of Corrosion Control Consultants & Labs (CCC&L); Gary Tinklenberg, of CCC&L; Kenneth Trimber, of KTA-Tator, Inc.; and Dr. Bernard Appleman, of SSPC.

For more details on the tutorial, write SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213-2683.

Paint Congress Slated For São Paulo, Brazil

The Second International Paint Congress and the Second International Exhibition of Paint Industry Suppliers will be held at the Anhembi Convention Centre, São Paulo, Brazil, on September 3-5.

The event is sponsored by the Brazilian Association of Paint Manufacturers (ABRAFATI).

Included in the technical program are six plenary sessions and 68 presentations. The sessions will cover the following subjects: "The Brazilian Paint Market, and the 90s"; "Paints—Environment, Health, and Safety"; "Quality—The Challenge of the Decade"; "Tendencies and Outlook for the Paint Industry: Technological and Marketing Aspects"; "Research and Development in Order to Attend to the Requirements of the 90s"; and "Paints—Techniques, Processes, and Equipment for Manufacturing and Application."

For more information, write: Específica S/C Ltda., Rua Augusta, 2516-2.° Andar-Conj. 22, 01412-São Paulo-SP-Brazil.

CALL FOR PAPERS

"Water-Based Coatings" Symposium

Sponsored by American Chemical Society Division of Polymeric Materials: Science and Engineering

April 5-10, 1992 San Francisco, CA

The American Chemical Society's Division of Polymeric Materials: Science and Engineering, will sponsor a symposium on "Water-Based Coatings," in San Francisco, CA, on April 5-10, 1992.

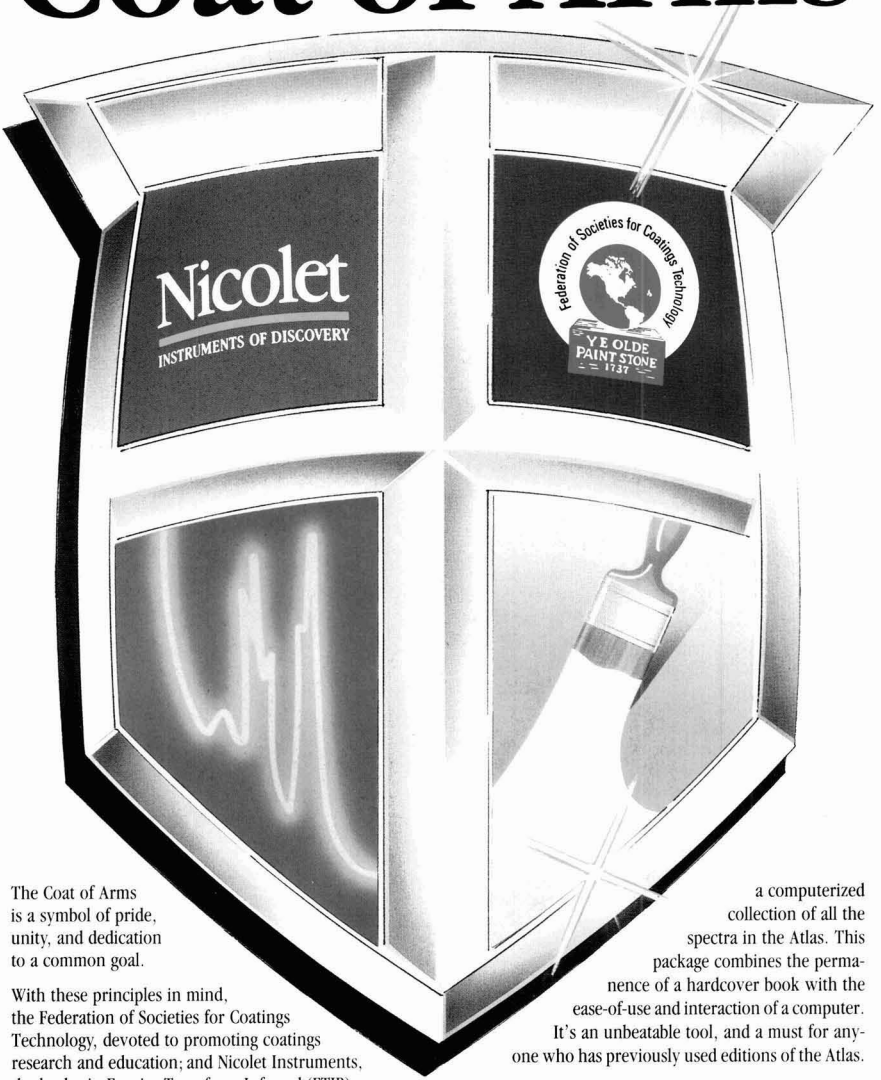
The symposium is designed to address all scientific and technological aspects of coatings which use water as the carrier liquid. Papers addressing both applied and fundamental issues relating to coatings carried in water are encouraged. Appropriate subjects include, but are not limited to: polymer types, end products, application properties, crosslinking, composite systems, film formation, modeling of behavior, and solubility in aqueous systems.

Short papers (two pages maximum) will be published in the *Polymeric Materials Science and Engineering Preprints*. The publication of a *Proceedings Book* is being considered. An expanded version of each preprint paper will be eligible as a chapter in the *Proceedings Book*.

Preliminary titles should be submitted to the symposium chairmen immediately. A 200-word abstract on an ACS form is due November 1, 1991. Also, the preprint manuscript on PMSE paper should be submitted by November 1, 1991. The book manuscript on ACS paper is due April 5, 1992.

To submit a preliminary title, or for more information, contact Symposium Chairmen: F. Louis Floyd, The Glidden Co., 16651 Sprague Rd., Strongsville, OH 44136; or John L. Massingill Jr., The Dow Chemical Co., Bldg. B-1603, Freeport, TX 77541.

Coat of Arms



The Coat of Arms is a symbol of pride, unity, and dedication to a common goal.

With these principles in mind, the Federation of Societies for Coatings Technology, devoted to promoting coatings research and education; and Nicolet Instruments, the leader in Fourier Transform Infrared (FTIR) technology, applications and instrumentation; have joined forces to provide you with a state-of-the-art tool for coatings identification and analysis.

We created a package featuring the new **FSCT Infrared Spectroscopy Atlas,** including over 2,500 coatings spectra, and the **Nicolet Coatings Technology Database,** a computerized collection of all the spectra in the Atlas. This package combines the permanence of a hardcover book with the ease-of-use and interaction of a computer. It's an unbeatable tool, and a must for anyone who has previously used editions of the Atlas.

In our alliance, both organizations contribute a spirit of service and quality. Whether your work involves quality control or R&D, we are dedicated to solving your problems. We'd be happy to demonstrate how this package or any of our spectrometers can bring the power of FTIR to your lab.

For more information, call 1-800-232-1472.

New Coatings Identification and Analysis Package

Book Review

POLYMER ASSOCIATION STRUCTURES: Microemulsions and Liquid Crystals

Edited by
Magda A. El-Nokaly

Published by
American Chemical Society
1155-16th St., N.W.
Washington, D.C. 20030
$79.95 (1989)

Reviewed by
Darlene R. Brezinski
Consolidated Research, Inc.
Mount Prospect, IL

This book can be very useful for researchers in a variety of chemical related fields. It focuses on a very narrow area that is unique because it bridges the gap between polymer science and colloidal chemistry. The goal of the book was to investigate polymer-polymer or polymer-surfactant interactions in solution leading to association structures with properties such as solubilization and anisotropy. Hence, the usefulness of this book to the detergent, paint, pharmaceutical, cosmetic, agricultural, and textile industries.

The first eight chapters are devoted to the formation and characterization of the microemulsion aspect of polymer association structures in water-in-oil, middle-phase, and oil-in-water systems. Polymerization in microemulsions and potential applications are reviewed very nicely with extensive literature references being cited. Differences between macroemulsions (conventionally known as emulsions), mini-emulsions, and microemulsions are clearly noted and well defined. Brief reviews of various studies of microemulsion polymerization may be found; most of the published work in this field has dealt with the formation of microlatex particles. Novel porous polymers have many potential applications such as conductive polymers, polymer composites, and ultrafiltration.

A very nice chapter is also included on microlatex preparation with functional polyesters. Microlatexes based on acrylic polymers modified by polyesters are an interesting approach to waterborne coatings leading to high gloss paint films.

Chapters 9 through 15 are devoted to liquid crystals. Discussed are mesophase formation of a polypeptide, cellulose, and its derivatives in various solvents, emphasizing theory, novel systems, characterization, and properties.

The third part of the book, Chapters 16-21, treats polymer-polymer associations and polymer-surfactant associations. Phase separation dynamics and kinetic association between polymer latex particles are reviewed. For the kinetic study, advantage was taken of latex particles being large enough to be seen under an ultramicroscope connected to an image-processing system. Thus the kinetic laws were examined directly by visual imagery. The colloidal properties of a surface-active cellulosic polymer were also discussed.

Polymer-surfactant associations were discussed in a chapter on macromolecules for the control of distances in colloidal dispersions. The subtleties of polymer covered particles are examined. Also covered in the book are the interactions of water-soluble polymers with microemulsions and surfactants, as well as polymer chain interactions in mixed surfactant systems.

In summary, the book is a valuable source for the polymer chemist as it presents some sound experimental work, cites many practical applications, and is well referenced.

FIFTEENTH INTERNATIONAL CONFERENCE IN ORGANIC COATINGS SCIENCE AND TECHNOLOGY (Volume 13)

Edited by
Angelos V. Patsis

Published by
Technomic Publishing Co.
851 New Holland Ave.
Box 3535
Lancaster, PA 17604
530 Pages (1991)

Reviewed by
Thomas J. Miranda
Whirlpool Corp.
Benton Harbor, MI

This book is a compilation of a series of papers which were presented at the 15th International Conference in Organic Coatings Science and Technology held in Athens, Greece, on July 10-14, 1989. The volume contains papers presented there which include: a plenary lecture by Dr. J.P. McTague on the role of research in automotive coatings. This is followed by research papers on color control in waterborne automotive coatings, analysis of HALS stabilizers in automotive coatings, degradation mechanisms and structural analysis of resins, and accelerated testing design for coatings systems. Some of the more prominent papers were: "Structure-Property Relations of Coatings from New Oligomeric Crosslinkers," by L.W. Hill and K. Kozlowski, "Liquid Crystal Polymers as Binders for Coatings," by F.N. Jones et al., and "New Acrylic Resins with Low Formaldehyde Emission," by J. Rietberg et al.

In all, this volume contains 36 papers which represent a wide variety of coatings subjects. One of the good features of this series is that the papers represent a state-of-the-art review in many cases, and the papers are well written. They become a valued source of information to the coatings technologist and are a credit to the Series Director, Angelos Patsis. For those who have followed the series, this is another welcomed addition.

Literature

Epoxy Primer

A water-based catalyzed epoxy primer for high-performance protection of iron and steel is detailed in a product release. As part of a coating system, the primer can be used in a variety of industries, including refineries, power plants, and food and beverage facilities, for coating processing tanks, storage tanks, manufacturing equipment, structural steel, and pipe racks. All inquiries for additional information should be identified as "Water-Based Catalyzed Epoxy Primer (SWS-3578)," and sent to The Sherwin-Williams Co., c/o HKM Direct, 5501 Cass Ave., Cleveland, OH 44102.

Zirconium Mill Beads

The introduction of a new series of zirconium silicate and pure zirconium oxide mill beads has been made through literature. The zirconium silicate is available with a density of 4.2 g/cc and the zirconium oxide with a density of 5.5 g/cc. For more in-depth details, write Tom Weiss, Quackenbush Co., 500 E. Main St., Lake Zurich, IL 60047.

Machining Coolant

A data sheet presenting a comprehensive program and kit for monitoring critical coolant parameters has been issued. The literature illustrates both the standard and optional equipment and recommended forms for scheduling and recording data. Write Man-Gill Chemical Co., 23000 St. Clair Ave., Cleveland, OH 44117 for more details.

Laser-Designed Impellers

A family of laser-designed impellers is the feature of a four-page, quarterly newsletter. The literature also includes information on a line of laboratory mixers. For a free copy of the *LIGHTNIN® Impeller*, contact Betty Felix, Lightnin, 135 Mt. Read Blvd., Rochester, NY 14603.

Air Spray Painting Systems

Data has been released on a complete spray painting machine that is designed for spraying a wide variety of decorative, protective, and maintenance coatings such as latex, enamels, stains, multi-colors, lacquers, and varnishes. Write Binks Manufacturing Co., Advertising Dept., 9201 Belmont Ave., Franklin Park, IL 60131 for more information on the Zephyr Stroller Outfit.

Flowmeters

The introduction of two flowmeters designed for measuring refined petroleum products, including unleaded gasolines, diesel fuel, kerosene, fuel oil, aviation gasoline, and jet fuels has been made through a data sheet. Both flowmeters are available with standard accessories, which include counter, printer, preset, strainer, air eliminator, and valve. Details on the M-40 and MS-40 flowmeters are obtainable by writing Liquid Controls Corp., Wacker Park, North Chicago, IL 60064.

Surfactants

An updated data sheet describing a line of surfactants has been printed. The information offers tips for formulating with these performance additives to be used in applications such as water-based coatings, inks, pigments and dispersion, dyes, paper coatings, adhesives, agricultural chemicals, metalworking lubricants, and oilfield chemicals. Write Air Products and Chemicals, Inc., Performance Chemicals Div., 7201 Hamilton Blvd., Allentown, PA 18195-1501 for a copy of the data sheet entitled, "How to Formulate with Surfynol® Surfactants."

Photo-Gel Time Measurement

A product bulletin introduces an instrument developed to measure photo-gel time of polymerizable compositions. The device can reportedly resolve differences in formulation, initiator or inhibitor concentrations, consistency with age, gel rate versus temperature, etc. that can be used for control or development purposes. Literature is available that includes an owner's guide for a close-up look at the instrument with full-color photographs. For further information, write E.J. Saccocio, Gel-Pointe Scientific Instruments, 1790 Sugar Run Trail, Bellbrook, OH 45305.

Sealant Adhesive

A one-part sealant adhesive having a paste-like consistency which makes it easy to apply on vertical or overhead surfaces is the topic of recently released literature. Available in gray, white, or black, the adhesive comes in a 310 mL cartridge for extrusion by a conventional mastic or pressure-fed cartridge gun. Inquiries for more information on Pur-Flex can be sent to W. Barclay, Stag Polymers and Sealants Ltd., Tavistock Rd., West Drayton, Middlesex, England UB7 7RA.

Analytical Laboratory

A technical newsletter focusing on analytical laboratory and process control instrumentation has been published. The six-page full-color publication features technical articles, product news, application tips, and technical data on lab/process instruments and their use. For a copy of the issue, "Analytical Lab REPORT," and a free subscription to future issues, contact Lauren Walters, Mettler Instrument Corp., P.O. Box 71, Hightstown, NJ 08520-0071.

Filter Bags

A line of replacement filter bags for housing is the subject of a six-page, full-color catalog. Filter bag materials include polyester, polypropylene, nylon, and nomex. Contact Sheri Kirsgalvis, LeSac Corp., 416 Scott St., Michigan City, IN 46360 for a copy of Catalog RFB-100.

Indoor Exposure System

Literature has been released on an indoor actinic exposure system which reportedly determines the color stability and durability of materials exposed to interior lighting. Other applications include coatings, fibers, dyestuffs, inks, and photographic films that are exposed to long-term indoor lighting. For more details on the HPUV Indoor Actinic Exposure System, write Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613.

Cadmium Pigments

The introduction of a new series of cadmium pigments specially treated to be low dusting and to have low cadmium solubility has been made through a data sheet. These pigments were formulated to help users meet OSHA handling and EPA waste disposal requirements. Contact Engelhard Corp., Specialty Minerals and Colors Group, 101 Wood Ave., Iselin, NJ 08830 for more details on Mindust™ cadmium pigments.

Polyurethane Potable Water Coating

A product data sheet describes a polyurethane potable water coating. The coating reportedly is an instant setting polyurethane which can be spray applied in one coat at temperatures down to -15°F. For more complete details on Corrocote II PW, write Madison Chemical Industries Inc., 5673 Old Dixie Rd., Ste. 160, Forest Park, GA 30050.

Emulsion

Technical information on an emulsion of natural asphalt hydrocarbon resin for use in aqueous products such as wood stains, inks, adhesives, and products made from asphalt emulsions has been released. The product is designed to avoid the use of toxic and hazardous solvents. Contact Lorna Silverton, Allo Colouring Co., 21408 S.E. 37th St., Issaquah, WA 98027 for further details on Aquaphalt®.

Engineering Resin

Plastic parts made of a high-temperature polymer that can reportedly withstand temperatures of 650°F for extended periods, is the subject of a recently released data sheet. The resin, based on polybenzimidazole, is designed for the process and refining industries as its use in industrial equipment increases. For additional information on the Celazole® polymer, write PBI Performance Parts, Hoechst Celanese Corp., 18207 Chisholm Trail, Ste. 216, Houston, TX 77060.

Aliphatic Polyurethane Emulsion

An aliphatic polyurethane dispersion resin for use by coatings and adhesive formulators is the subject of a recently released technical bulletin. The resin film reportedly forms at room temperature and compounds with water-based acrylics and water-based epoxies for coatings on wood, metal, plastic, paper, vinyl, and masonry. More details on QW18 can be obtained by writing K.J. Quinn & Co., Inc., 135 Folly Mill Rd., Seabrook, NH 03874-0158.

Sprayer

The introduction of a sprayer which features a three-stage tangential turbine with variable speed control has been made through literature. Designed for application of stains, lacquers, sealers, oil-based paints, and finish quality latexes on metal work, woodwork, cabinets, decks, and moldings, the sprayer utilizes a high volume of low pressure air to atomize finish grade coatings. For further information on the Pro-Finish 300 HVLP sprayer, contact Titan Tool, Inc., 107 Bauer Dr., Oakland, NJ 07436.

Color Dispersions

The introduction of a new line of color dispersions which can reportedly be poured and stirred into water-based ink formulations has been made through literature. Available pigments include AAOT yellow, dianisidine orange, barium lithol red, phthalo blue GS, phthalo blue RS, and phthalo green BS. Additional colors are being developed. Contact Engelhard Corp., 101 Wood Ave., Iselin, NJ 08830-0770 for more detailed information of Omnicryl™ colors.

Infrared Spectroscopy

A 64-page, four-color infrared spectroscopy supplies catalog has been printed. The catalog features supplies and optical accessories for all FT-IR and dispersive spectrophotometers used for analyzing liquid, solid, and polymeric samples in paint and coatings labs. For a free copy of the winter/spring edition of the "Infrared Spectroscopy Supplies Catalog," write PE XPRESS, The Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0156.

Defoamers

The introduction of a defoamer line 100% free of volatile organic compounds (VOC) has been made through a data sheet. These products are formulated for the diverse needs of the paint, ink, and coatings industries. Copies of the technical bulletin providing further information on the Bubble Breaker® product line can be obtained from the Surfactants Dept., Organics Div., Witco Corp., 520 Madison Ave., New York, NY 10022-4236.

Composite Impeller

A new mixer featuring a three-bladed, axial-flow impeller, which is chemical resistant and suitable for waste and water treatment, pulp and paper storage, and other highly corrosive storage applications, is the subject of recently released literature. Impeller diameters range from 98.0-135.0 inches. Contact Betty Felix, Lightnin, 135 Mt. Read Blvd., Rochester, NY 14611 for further details on the Lightnin SX™ mixer with A6100™ impeller.

Surface Contamination

A new approach to detecting invisible surface contamination after blast cleaning operations is the subject of a recently released data sheet. The literature describes the method of determining the presence of invisible contaminants including chlorides, sulfates, and soluble iron salts as well as total moisture and total residual salt content. For more information on the Bresle Sampler™ and Bresle Kit, write KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275.

Surface Area Analyzer

A technical data sheet describing a standard flowing-gas surface area analyzer has been issued. The following specifications are presented in the literature: applicability, pressure measurement, vacuum system, environment, sample tubes, electrical, gases, and physical properties. For more information, write Micromeritics, One Micromeritics Dr., Norcross, GA 30093-1877.

Instruments

The availability of a 200-page, fully illustrated catalog of instruments for testing coatings, inks, shell casting slurries, etc., has been announced. The publication lists the full descriptions, specification references, and operation instructions of the instruments. For a complimentary copy of "New Testing Instruments and Equipment," write Paul N. Gardner Co., Inc., P.O. Box 10688, Pompano Beach, FL 33061-6688.

Books in Print . . .

ASTM Protective Coating Standards for Use in Nulear Power Plants, 1991, 60 pp. List price: $35.00. Member price: $31.00—ASTM Customer Service, 1916 Race St., Philadelphia, PA 19103.

ANTEC 91—In Search of Excellence, Proceedings from 49th Annual Technical Conference of the Society of Plastics Engineers, 1991, 2,730 pp. List price: $200.00—Technomic Publishing Co., Inc., 851 New Holland Ave., Box 3535, Lancaster, PA 17604.

Manual on Maintenance Coatings for Nuclear Power Plants, 1990, 41pp. List price: $32.00. Member price: $25.60—ASTM Customer Service, 1916 Race St., Philadelphia, PA 19103.

Plastics and the Environment: Progress and Commitment, 1990, 128 pp. List price: $12.50. Member price: $10.00—The Society of the Plastics Industry, Inc., 1275 K St., N.W., Ste. 400, Washington, D.C. 20005.

A Practical Guide to the Care, Maintenance, and Troubleshooting of Capillary Gas Chromatographic Systems, 182 pp. List price: $45.00—J&W Scientific, 91 Blue Ravine Rd., Folsom, CA 95630.

ANSI Global Standardization Report, Fourth Volume, 26 pp. List price: $65.00. Member price: $25.00—American National Standards Institute, ANSI Sales, 11 W. 42nd St., New York, NY 10036.

Disperser

A disperser which can be used as a dispersion mill and/or transfer pump is the subject of literature. This maximum shear, in-line disperser is designed for use in the paint, adhesive, and general chemical industries. More information on the Max-Shear Disperser can be obtained by writing Premier Mill Corp., Exeter Industrial Park, Birchmont Dr., Reading, PA 19606.

Black Oxide

A four-page design guide detailing the common applications for black oxide treatment has been issued. Applications include fasteners, metal stampings, tie-rods, and other metal parts made from brass, bronze, copper, steel, stainless steel, and zinc die cast. The brochure also lists the ranges of salt spray equivalency testing. For a free copy of the design guide, write Cleveland Black Oxide Co., 836 Broadway Ave., Cleveland, OH 44225.

Progressive Cavity Pumps

Data has been released on progressive cavity pumps with output capacities ranging from 0-10 L/min, depending on speed, and pressure capabilities up to 225 psi. Housing, rotor, and stator are available in a variety of materials to suit specific applications. More information on 3NE Progressive Cavity Pumps can be obtained by writing Netzsch Inc., 119 Pickering Way, Exton, PA 19341-1393.

Finishing Terms

A pocket sized, 14-page booklet describing the jargon used in today's finishing industry has been released. Definitions are given in common, everyday language. Illustrations throughout the glossary depict the concepts that may be more difficult to understand. To receive a copy of "Glossary of Automated Finishing Terms," write Glossary Request, DeVilbiss Ransburg Industrial Liquid Systems, P.O. Box 913, Toledo, OH 43612-0913.

Solid Peroxygen

A time-release, solid peroxygen chemical for environmental treatment has been introduced in a product data bulletin. The product is specifically designed to provide reliable, controlled release of oxygen *in-situ* to wastewater, sludge, and soil for dechlorination, deodorization, conditioning, and bioenhancement. Write FMC Peroxygen Chemicals Div., 2000 Market St., Philadelphia, PA 19103 for a brochure with more details on PermeOx™.

Rheology Neoprene

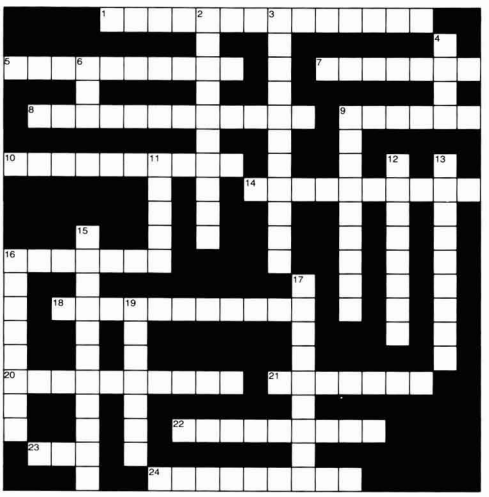
A line of direct-dissolve neoprene polychloroprene for unmilled adhesives is the subject of a product bulletin. Several grades of varying viscosities are available to allow for a wide range of adhesive formulations. The direct-dissolve grades are designed to replace standard grades of the same viscosity. For a copy of the brochure describing this line of rheology neoprene, contact Du Pont Polymers Inquiry Handling Center, Barley Mill Plaza—Canby Mill, P.O. Box 80011, Wilmington, DE 19880-0011.

Aliphatic Urethane

The introduction of a new fully reacted aliphatic urethane has been made through literature. The new waterborne polyurethane elastomer reportedly offers resistance to chemicals (including household cleaning agents), stains, and solvents when used alone or in combination with acrylic emulsions. For more information or a sample of EA-6233 water-dispersible polyurethane elastomer, contact Reichhold Chemicals, Inc., P.O. Box 13582, Research Triangle Park, NC 27713.

CrossLinks

by Earl Hill



No. 43

Solution to be Published in September Issue

ACROSS

1. A class of pigments with superior properties
5. What is a reversible aggregate of colloidal droplets?
7. Plasticizer in Celluloid
8. To copy by tracing
9. Red (Syn.)
10. To come apart
14. What is an enclosure for drying found in the chemical laboratory?
16. Unit of heat measurement
18. This is one over the resistance, C_____
20. Adverse skin condition
21. Word with black
22. Takes off oils, grease, and grime
23. Follower of fish (Sing.)
24. That which cleans

DOWN

2. Paint type used on cars
3. How thick it is (Rheol.)
4. Yet another word with black
6. Cellulosic thickener (Abr.)
9. Coating based on chalk and glue
11. Loose term applied to elasticity (Rheol.) N_____
12. What are organisms that attack paint?
13. This dye is the color of 9 Across, C_____
15. A meter that measures color
16. Natural aluminum oxide abrasive
17. Modern technique used in art, D_____E
19. Starch-derived, water soluble thickener or additive

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.

1991

(Sept. 24-26)—Statistical Process Control for the Coatings Industry (Level II) Seminar. Airport Hilton Hotel, Toronto, Ontario, Canada.

(Nov. 4-6)—69th Annual Meeting and 56th Paint Industries' Show. Convention Center, Toronto, Ontario, Canada.

1992

(May 17-20)—Federation "Spring Week." Board of Directors Meeting on the 17th; Incoming Society Officers Meeting on the 18th; Spring Seminar on the 19th and 20th. Sheraton Boston Hotel and Towers, Boston, MA.

(Oct. 21-23)—70th Annual Meeting and 57th Paint Industries' Show. McCormick Place, Chicago, IL.

1993

(Oct. 27-29)—71st Annual Meeting and 58th Paint Industries' Show. World Congress Center, Atlanta, GA

SPECIAL SOCIETY MEETINGS

1992

(Feb. 26-28)—Southern Society. 19th Annual Waterborne, Higher-Solids, and Powder Coatings Symposium. Co-sponsored by the Department of Polymer Science at the University of Southern Mississippi (USM). New Orleans, LA. (Robson F. Storey and Shelby F. Thames, Co-Organizers, WBHS&PC Symposium, Dept. of Polymers Science, USM, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Mar. 11-13)—Southern Society Annual Meeting. Grosvenor Resort Hotel, Orlando, FL. (Billy Lee, Kemira, Inc., P.O. Box 368, Savannah, GA 31402).

(Mar. 29-31)—Houston and Dallas Societies. Southwestern Paint Convention. South Shore Harbour Resort & Conference Center, League City (Houston), TX. (Dennis Crozier, Crozier-Nelson Sales, Inc., 2505 Collingsworth, Houston, TX 77026).

OTHER ORGANIZATIONS

1991

(Sept.)—"Computer Solutions for Formula-Based Manufacturers" Seminar. Sponsored by Pacific Micro Software Engineering and Kaplan & Associates, Inc. Dates and locations to be announced. (Pacific Micro Software Engineering, 1500 Pacific Coast Hwy., Ste. E, Seal Beach, CA 90740).

(Sept. 3-5)—2nd International Paint Congress. Sponsored by The Brazilian Association of Paint Manufacturers (ABRAFATI). Anhembi Convention Centre, São Paulo, Brazil. (Especifica S/C Ltd., Rua Augusta, 2516—2nd Floor, Ste. 22, 01412, São Paulo, SP, Brazil).

(Sept. 4-5)—"Removal of Lead Paint" Tutorial. Sponsored by Steel Structures Painting Council (SSPC). Hyatt Regency O'Hare, Chicago, IL. Other tutorial dates and locations include: Sept. 11-12— Radisson Airport Hotel, Philadelphia, PA; Sept. 23-24— Hyatt Regency Houston, Houston, TX; Sept. 25-26—Holiday Inn Crown Plaza, New Orleans, LA; and Oct. 2-3—Boston Park Plaza, Boston, MA. (SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213-2683).

(Sept. 9-13)—63rd Introductory Short Course on "The Basic Composition of Coatings." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (Norma Fleming, Sr. Continuing Education Coordinator, UMR, 119 M.E. Annex, Rolla, MO 65401-0249).

(Sept. 10-12)—North American Hazardous Materials Management Conference and Exhibitionion. Sponsored by *HazMat World* magazine. Cobo Hall, Detroit, MI. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E, Ste. 408, Glen Ellyn, IL 60137).

(Sept. 10-12)—Adhesives '91: Technology for Manufacturing with Adhesives. Conference and Exhibit sponsored by The Society of Manufacturing Engineers (SME). Hyatt Atlanta Airport, College Park (Atlanta), GA. (Patricia Jones, SME, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930).

(Sept. 12-13)—"Fundamentals of Color" Seminar. Sponsored by Macbeth, Division of Kollmorgen Instruments Corporation. Boston, MA. Other dates and locations include: Oct. 10-11—San Diego, CA; Oct. 24-25—King of Prussia, PA; Nov. 7-8—Detroit, MI; Nov. 13-14—Birmingham, AL; and Dec. 5-6—Raleigh, NC. (Wanda Smith, Macbeth, P.O. Box 230, Newburgh, NY 12551-0230).

(Sept. 15-18)—79th Annual Canadian Paint and Coatings Association (CPCA) Convention. Le Chateau Montebello, Montebello, Quebec, Canada. (CPCA Convention, 9900 Cavendish Blvd., Ste. 103, Montreal, Quebec, Canada, H4M 2V2).

(Sept. 17-20)—Eurocoat 91. XIX International Congress/Exibition. Nice, France. (A. Chauvel, AFTPV, 5, rue Etex, 75018 Paris, France).

(Sept. 23-25)—Finishing '91 Conference and Exposition. Sponsored by the Society of Manufacturing Engineers (SME) and the Association for Finishing Processes. Dr. Albert B. Sabin Convention Center, Cincinnati, OH. (SME Event Public Relations Dept., One SME Dr., P.O. Box 930, Deaborn, MI 48121).

(Sept. 23-25)—"Polymer Blends and Alloys." Seminar sponsored by The Division of Polymeric Materials Science and Engineering of the American Chemical Society. Hilton Head Island Beach and Tennis Resort, Hilton Head, SC. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Sept. 24-26)—The Polyurethanes World Congress 1991. Co-sponsored by the European Isocyanate Producers Association and the Polyurethane Division of The Society of Plastics Industry (SPI), Inc. of the USA. Acropolis Arts & Convention Center, Nice, France. (Fran Lichtenberg, Polyurethane Div., SPI, 355 Lexington Ave., New York, NY 10017).

(Sept. 24-26)—Finishing '91. Exhibition sponsored by Turret Group plc. Telford Exhibition Centre, Telford, Shropshire, England. (Nigel Bean, Exhibition Sales Manager, Turret Group plc, Turret House, 171 High St., Rickmansworth, Herts, WD3 1SN, England).

(Sept. 29-Oct. 2)—RADTECH Europe '91 Conference and Exhibition. Edinburgh Exhibition and Trade Centre, Edinburgh, Scotland. (Exhibit Manager, RADTECH 91, c/o FMJ International Publications Ltd., Queensway House, 2 Queensway, Redhill, Surrey, RH1 1QS, United Kingdom or Conference Secretary, RADTECH '91, c/o PRA, Waldegrave Rd., Teddington, Middlesex, TW11 8LD, England).

(Oct.)—ASTM Committee B-8 on Metallic and Inorganic Coatings meeting. Philadelphia, PA. (George A. DiBari, International Nickel Co., Park 80 West—Plaza Two, Saddle Brook, NJ 07662).

(Oct. 2-4)—Hazardous Materials Management Conference and Exhibition/South (HazMat/South). Sponsored by *HazMat World*

magazine. Georgia World Congress Center, Atlanta, GA. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E, Ste. 408, Glen Ellyn, IL 60137-5835).

(Oct. 7-10)—"Introduction to Coatings Technology." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(Oct. 9-11)—"Verbundwerk '91." 3rd International Trade Fair on Composite Technology, Reinforced Plastics, Metals, and Ceramics. Rhein-Main-Halls, Wiesbaden, Germany. (Diana Schnabel, DEMAT, Postbox 110 611, 6000 Frankfurt 11, Germany).

(Oct. 14-18)—"Scanning Electron Microscopy and Microanalysis for Polymeric Science." Conference sponsored by the State University of New York (SUNY). Nevelle Resort Hotel, Ellenville, NY. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Oct. 16-18)—"Accelerated and Natural Weathering Techniques for Coatings and Polymers." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(Oct. 20-24)—ASTM Committee D-13 on Textiles Meeting. Wyndham Franklin Plaza, Philadelphia, PA. (Bode Buckley, ASTM, 1916 Race St., Philadelphia, PA 19103-1187).

(Oct. 21-23)—104th Annual Meeting of the National Paint & Coatings Association (NPCA). San Francisco Hilton Hotel, San Francisco, CA. (NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Oct. 21-24)—Euro–Asian Interfinish '91 Conference. (Aviezer Israeli, Chairman, The Metal Finishing Society of Israel, Ortra Ltd., P.O. Box 50432, Tel–Aviv 61500, Israel).

(Oct. 21-25)—23rd Introductory Short Course on "Paint Formulation." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (Norma Fleming, Sr. Continuing Education Coordinator, UMR, 119 M.E. Annex, Rolla, MO 65401-0249).

(Oct. 27-31)—ASTM Committee D-33 on Protective Coating & Lining Work for Power Generation Facilities Meeting. Cocoa Beach Holiday Inn, Cocoa Beach, FL. (Susan Canning, ASTM, 1916 Race St., Philadelphia, PA 19103-1187).

(Oct. 28-30)—"Advances in Polymer Colloids/Emulsion Polymers: Polymerization, Characterization, and Applications." Course sponsored by the State University of New York (SUNY). Orlando, FL. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Oct. 28-30)—"Science and Technology of Coatings." Course sponsored by the State University of New York (SUNY). Orlando, FL. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Oct. 28-Nov. 1)—"Fundamentals of Chromatographic Analysis." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(Oct. 28-Nov. 1)—Ninth International Conference on "Photopolymers," on Oct. 28-30, and Fourth International Conference on "Polyimides," on Oct. 30–Nov. 1. Sponsored by the Society of Plastics Engineers, Inc. (SPE). The Nevele Country Club, Ellenville, NY. (Prabodh Shah, c/o SPE, Mid Hudson Section, P.O. Box 546, Hopewell Junction, NY 12533).

(Nov. 4-5)—"Electrochemical Impedance: Analysis and Interpretation." Symposium sponsored by ASTM Committee G-1 on Corrosion of Metals. San Diego, CA. (John R. Scully, Sandia National Labs., Org. 1834, P.O. Box 5800, Albuquerque, NM 87185).

(Nov. 4-6)—Specialty Plastics Conference '91. Sponsored by Maack Business Services. Hotel International, Zurich-Oerlikon, Switzerland. (Dawn Singer, Maack Business Services, Moosacherstrasse 14, CH-8804 Au/Zurich, Switzerland).

(Nov. 6-8)—POWDEX. Organized by Cahners Exhibition Group. Georgia World Congress Center, Atlanta, GA. (Angela Piermarini, Show Manager, Cahners Exposition Group, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, IL 60017-5060).

(Nov. 7-8)—"Paint Volatile Organic Compounds." Course presented by ASTM, Toronto, Ont., Canada. (Kathy Dickinson, ASTM, 1916 Race St., Philadelphia, PA 19103).

(Nov. 8-12)—1991 International Surface Finishing & Coatings Exhibition (SF China '91) and the 1991 International PC Board Making & Electro-Chemicals Exhibition (PCB China '91). Shanghai Exhibition Center, Shanghai, P.R. China. (Sinostar International Ltd., 10A Harvest Moon House, 337-339 Nathan Rd., Kowloon, Hong Kong).

(Nov. 10-15)—1991 National Conference and Exhibition of Steel Structures Painting Council (SSPC). Long Beach Convention Center, Long Beach, CA. (SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213-2683).

(Nov. 11-13)—"Fundamentals of Adhesion: Theory, Practice, and Applications." Course sponsored by the State University of New York (SUNY). New Orleans, LA. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Nov. 18-22)—North American Research Conference on Crosslinked Polymers. Sponsored by the Division of Polymeric Materials: Science and Technology of the American Chemical Society. Marriott's Hilton Hotel Resort, Hilton Head, SC. (Angelos V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Nov. 19-21)—14th Resins & Pigments Exhibition. Sponsored by the Oil & Colour Chemists' Association. The Paint Research Association's 11th International Conference on November 18-20. Brussels Exhibition Center, Belgium. (Jane Malcolm-Coe, PR & Publicity Manager, FMJ International Publications Ltd., Queensway House, 2 Queensway, Redhill, Surrey, RH1 1QS, United Kingdom).

(Nov. 20-21)—"Lithographic Printing—From Raw Materials to Waste Recycling—The Integrated Approach." International symposium sponsored by the Oil & Colour Chemists' Association (OCCA). Brussels, The Netherlands. (Yvonne Waterman, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, England HA0 2SF).

(Dec. 2-4)—"Electrochemical Techniques for Corrosion Measurement." Sixth annual symposium and refresher course sponsored by EG&G Princeton Applied Research. New Orleans, LA. (EG&G Princeton Applied Research, P.O. Box 2565, Princeton, NJ 08543).

(Dec. 2-6)—Fall Meeting of the Materials Research Society. Boston, MA. (Materials Research Society, Meetings Dept., 9800 McKnight Rd., Pittsburgh, PA 15237).

1992

(Feb. 18-20)—Hazardous Materials Management Conference and Exhibition/Northern California. San Jose Convention Center, San Jose, CA. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E—Suite 408, Glen Ellyn, IL 60137–5835).

(Feb. 23-26)—Williamsburg Conference, "Comparison of Color Images Presented in Different Media." Co-sponsored by the Inter-Society Color Council and the Technical Association of Graphic Arts, Colonial Williamsburg, VA. (Milton Pearson, RIT Research Corp., 75 Highpower Rd., Rochester, NY 14623).

(Mar. 9-13)—PITTCON '92 Conference. New Orleans Convention Center, New Orleans, LA. (Pittsburgh Conference, Dept. CFP, 300 Penn Center Blvd., Ste. 332, Pittsburgh, PA 15235-5503).

(Mar. 17-18)—Electrocoat/92. Sponsored by *Products Finishing* magazine. Drawbridge Inn, Ft. Mitchell, KY. (Greater Cincinnati Airport Area). (Cindy Goodridge, Gardner Management Services, 6600 Clough Pike, Cincinnati, OH 45244).

(Mar. 24-26)—Surface Coating '92. Conference and Trade Show sponsored by Chemical Coaters Association International (CCAI). Indianapolis Convention Center, Indianapolis, IN. (CCAI, P.O. Box 54316, Cincinnati, OH 45254).

(Apr. 1-8)—Surface Treatment '92 Exhibition. Hannover Fairgrounds, Hannover, Germany. (Hannover Fairs USA Inc., 103 Carnegie Ctr., Princeton, NJ 08540).

(Apr. 5-10)—"Water-Based Coatings" Symposium. Sponsored by American Chemical Society, Division of Polymeric Materials: Science and Engineering. San Francisco, CA. (F. Louis Floyd, The Glidden Co., 16651 Sprague Rd., Strongsville, OH 44136, or John L. Massingill Jr., The Dow Chemical Co., Bldg. B-1603, Freeport, TX 77541).

(May 11-14)—Powder & Bulk Solids '92 Conference/Exhibition. O'Hare Exposition Center, Rosemont (Chicago), IL. (Cahners Exposition Group, Dept. Powder & Bulk Solids '92, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, IL 60017-5060).

(June 14-18)—XXIth FATIPEC Congress. 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).

(Oct. 25-30)—Fourth Corrosion and Protection Iberoamerican Congress and First Panamerican Congress on Corrosion and Protection. Mar del Plata, Argentina. (CIDEPINT, 52 entre 121 y 122, 1900 La Plata, Argentina, South America).

(Nov. 4–6)—'92 International Conference on Colour Materials. Sponsored by the Japan Society of Colour Material. Osaka Sun Palace, Expo Park Senri, Osaka, Japan. (S. Tochihara, Chairman of Executive Committee of the '92 ICCM, c/o Japan Society of Colour Material, Kitamura Bldg. 5F, 9-12, 2-chome, Iwamoto-cho, Chiyoda-ku, Tokyo 101, Japan).

Advertisers Index

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'Humbug' from Hillman

Dave Platt, spouse of Doris, our poet laureate for June, and my lab associate of times long ago, sent us some tidbits from a source he chose not to mention. So—apologies to the unknown source (probably better that way).

• FAD: Something that goes in one era and out the other.

• PROSPERITY: Something you feel, fold, and forward to Washington.

• At income tax time, America is a land of untold wealth.

• Teenagers complain there's nothing to do but stay out all night doing it.

• Rain is something that makes flowers grow and taxis disappear.

• The most expensive vehicle to operate per mile is the shopping cart.

• My aunt explained why she finally decided to wear the mini. "If you're going to look ugly, you might as well look this year's ugly."

Thank you, Tommy Robertson, for sending the quote from *Rotary* magazine, "A Guide to Committee Report Jargon." It frequently happens, however, we get one or two other contributions from the same source. (See JCT, February 1991.) Here is one line that we salvaged, though:

—We explored all possible solutions to the problem. . . Everyone talked too much.

Thanks for your kind words, though, Tommy—stay in touch.

Dick Kiefer took time from his new career as a guide in the Independence Mall National Historical Park to send the following recipe. I guess that Dick leads safaris in the Park and is prepared for all emergencies.

Elephant Stew

1 Elephant
2 Rabbits, optional
Salt
Pepper

Cut the elephant into small bite-size pieces; this should take about two months. Add enough brown gravy to cover. Cook over kerosene fuel about four weeks at 465°. This should serve about 3800 people; if more are expected, rabbits may be added, but do this only if necessary as most people do not like to find hare in their stew.

Although "Humbug" rarely reprints items from *Chemical & Engineering News* and *Chem Tech*, since so many of our members subscribe to both, here is an apropos item you might have missed from *C&En.*

Jay Erikson, of Santa Fe, NM, wrote to report an adventure with his local recycling center. After extensive wielding of the paint brush, he found himself with several empty paint cans that were "not much different from food cans, tin plated on the outside and epoxy coated on the inside." The recycling center requires that you remove the tops, bottoms, and labels from cans and flatten them, but before going to the trouble, Erikson telephoned the center. The conversation went like this:

JE: Will you accept clean paint cans?

She: Sorry, but we don't accept any cans that have contained a chemical, only food cans.

JE: But food is a chemical.

She: But food is nontoxic.

JE: But the label on the cans says that this paint is nontoxic.

She: We don't accept PAINT cans!!

Feel free to blame Sid Lauren if you've heard this one time and time again. I quote:

Dear Humbug,

As you know we had an unusually mild winter in New England, with very little snow and exceptionally early advent of mud season. Although it is not really apropos for this year, this has prompted reappearance of a story that was heard in past years, when snowfall usually ranged from heavy to very heavy. An old timer, who always thought that he lived just inside the western boundary of Maine, was told that a new survey showed his house was actually located in New Hampshire. "Thank God!" he exclaimed. "I don't think I could'a stood another one'a them Maine wintas!"

• A high school freshman went to a basketball game and sat next to a very pretty girl. Trying to start a conversation, he said to her, "Do you see that man down there with the bald head in the front row? That's the school principal. He's the meanest man in town."

"Do you know who I am?" she asked. "I'm his daughter."

"Do you know who I am?" the boy asked. She shook her head, and he replied, "Thank goodness."

• One of the things that worries so many businessmen these days is the number of unemployed on the payroll.

• A father was always bragging to his son about what a great hunter he was. The son joined his father on his next hunting trip to see for himself if this was true. They sat in a duck blind for a long time when one lonely waterfowl winged its way through the sky. The father took aim, fired, and missed.

"Son," he said, "you have just witnessed a miracle. There flies a dead duck."

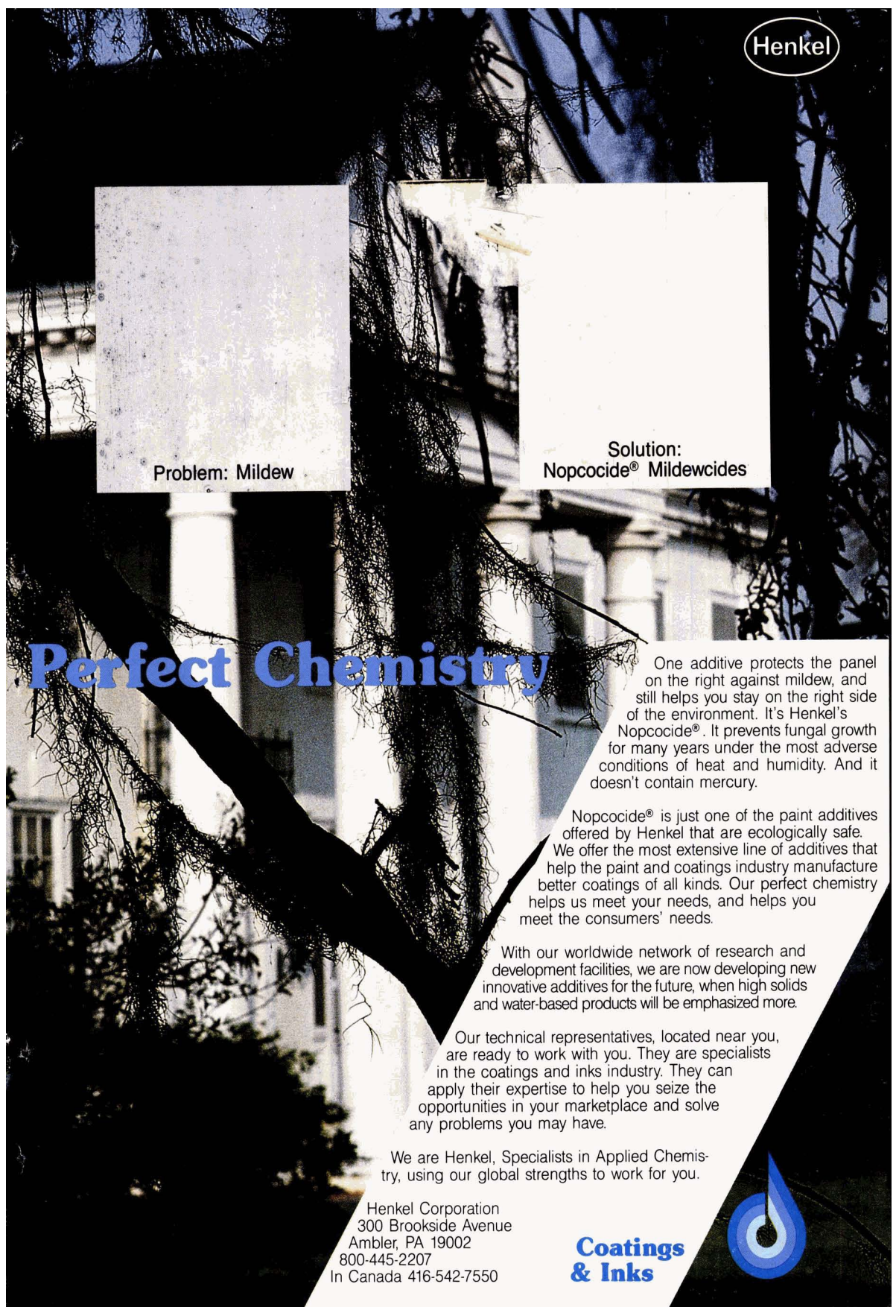
• A man paced up and down in front of a restaurant, glancing impatiently at the door. Inside, the cashier deduced that he was anxious to come in but something was holding him back. When the cashier had a free moment, he went outside and asked the man if there was anything he could do. "No, thank you," the man said. "I'm just waiting for the restaurant to open."

"Why, it is open," said the cashier.

"Don't try to kid me," said the man. "I can read. It says on the door there, just as plain as day, 'Home Cooking.'"

—The Lion

—Herb Hillman
Humbug's Nest
P.O. Box 135
Whitingham, VT 05361



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