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JOURNAL OF
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September 1989

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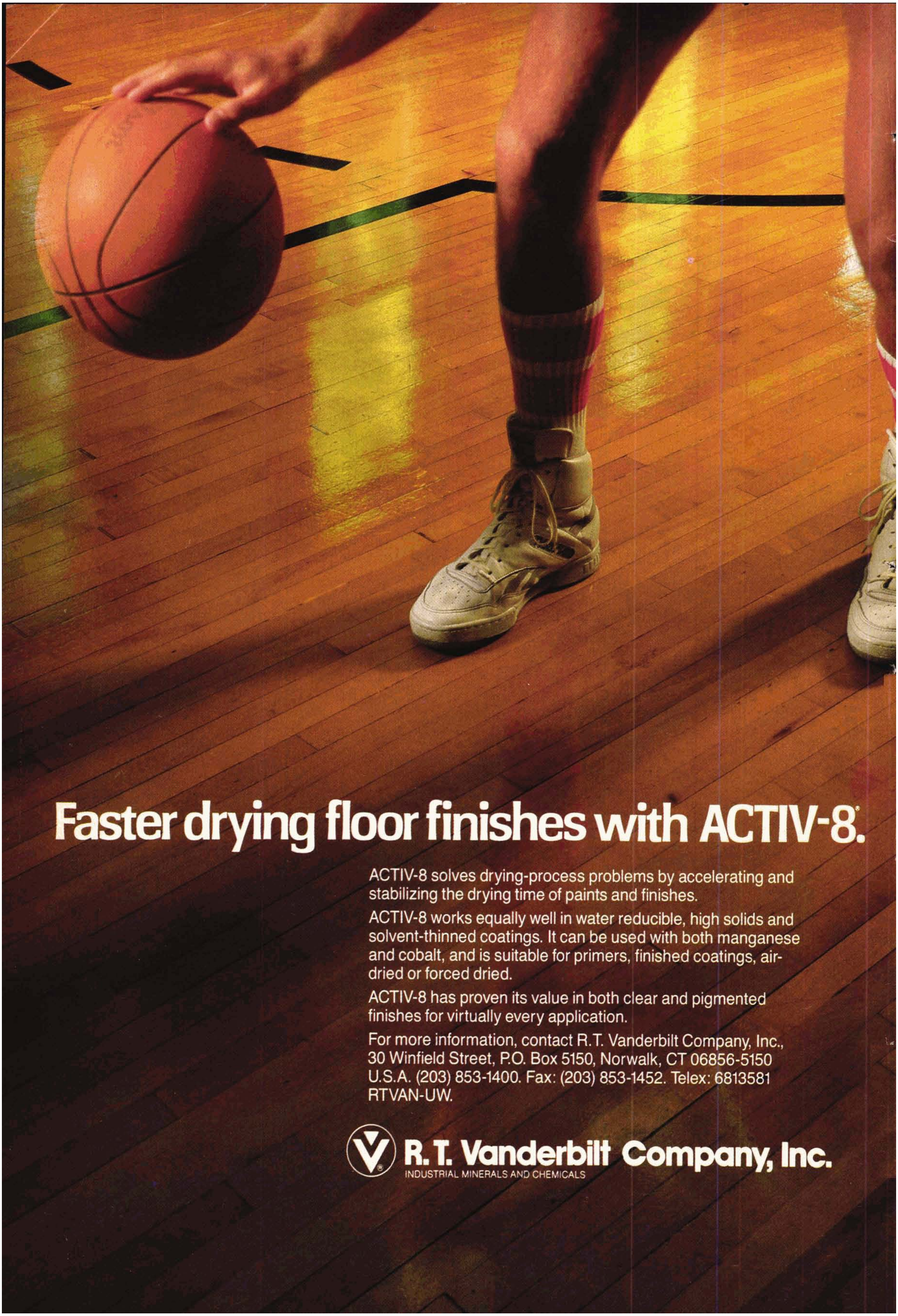
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VOLUME 61 NUMBER 776

Technical Articles

Federation News

Departments

THE JOURNAL OF COATINGS TECHNOLOGY (ISSN 0361-8773) is published monthly by the Federation of Societies for Coatings Technology, 1315 Walnut St., Philadelphia, PA 19107. Phone: (215) 545-1507.

Second class postage paid at Philadelphia, PA and at additional mailing offices. POSTMASTER: Send address changes to JOURNAL OF COATINGS TECHNOLOGY, 1315 Walnut St., Philadelphia, PA 19107.

Subscriptions: U.S. and Canada—1 year, $27; 2 years, $51; 3 years, $73. Europe (Air Mail)—1 year, $55; 2 years, $107; 3 years, $157. Other countries—1 year, $40; 2 years, $77; 3 years, $112.

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Annual dues for Active and Associate Members of the Federation of Societies for Coatings Technology is $20.00. Of this amount, $13.50 is allocated to a membership subscription to this publication. Membership in the Federation is obtained through prior affiliation with, and payment of dues to, one of its 26 Constituent Societies. Non-member subscription rates are:

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$27.00	$ 55.00	$ 40.00
2 Years	$51.00	$107.00	$ 77.00
3 Years	$73.00	$157.00	$112.00

When available, single copies of back issues of the JOURNAL OF COATINGS TECHNOLOGY are priced as follows: $3.00 each for current calendar year issues; $4.00 each for all other issues.

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The JOURNAL OF COATINGS TECHNOLOGY is available on microfilm from University Microfilms, a Xerox Co., Ann Arbor, MI 48106.

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FSCT Headquarters: An Update

It has been almost one year since the Federation Board of Directors gave their imprimatur to the construction of a permanent headquarters site for the FSCT. During the ensuing months, many locations were studied by the committee whose responsibility it was to select a site and develop parameters for the new building. President Jim Geiger and his Committee (Past-Presidents Jim McCormick, John Oates, and Deryk Pawsey, and Planning Committee Chairman Colin Penny) completed the major portion of their work in their selection and recommendation of a site to the Executive Committee following the Board Meeting last Spring.

The Executive Committee, in an extraordinary meeting on May 31, met in the Philadelphia area to view the chosen site and to discuss details of the acquisition with the developer. The Committee was impressed not only with the site location, but also with the dedication of the developer and the preliminary plans for the building. Approval was unanimous.

As approved, the headquarters would be located near Blue Bell, Pennsylvania, a pre-Revolutionary War suburban town 15 miles northwest of Center City Philadelphia. The site is close to major highways, including the Pennsylvania Turnpike and a major north-south freeway, now under construction, which will connect with the Philadelphia Airport.

The headquarters is planned as a two-story, 9,800 sq ft office building, with 4,000 sq ft of additional basement storage, situated on a six-plus acre office park. The surrounding area is a comfortable mixture of suburban office parks and residences and rural farm land, giving one the feel for "country living" with all of the services necessary to conduct a major business.

As we go to press, the construction agreements and building plans are being finalized with the hope of completion of construction by early 1990. And as we progress toward that completion, we will continually update the membership through the JCT.

Robt F. Ziegler

Robert F. Ziegler
Executive Vice President

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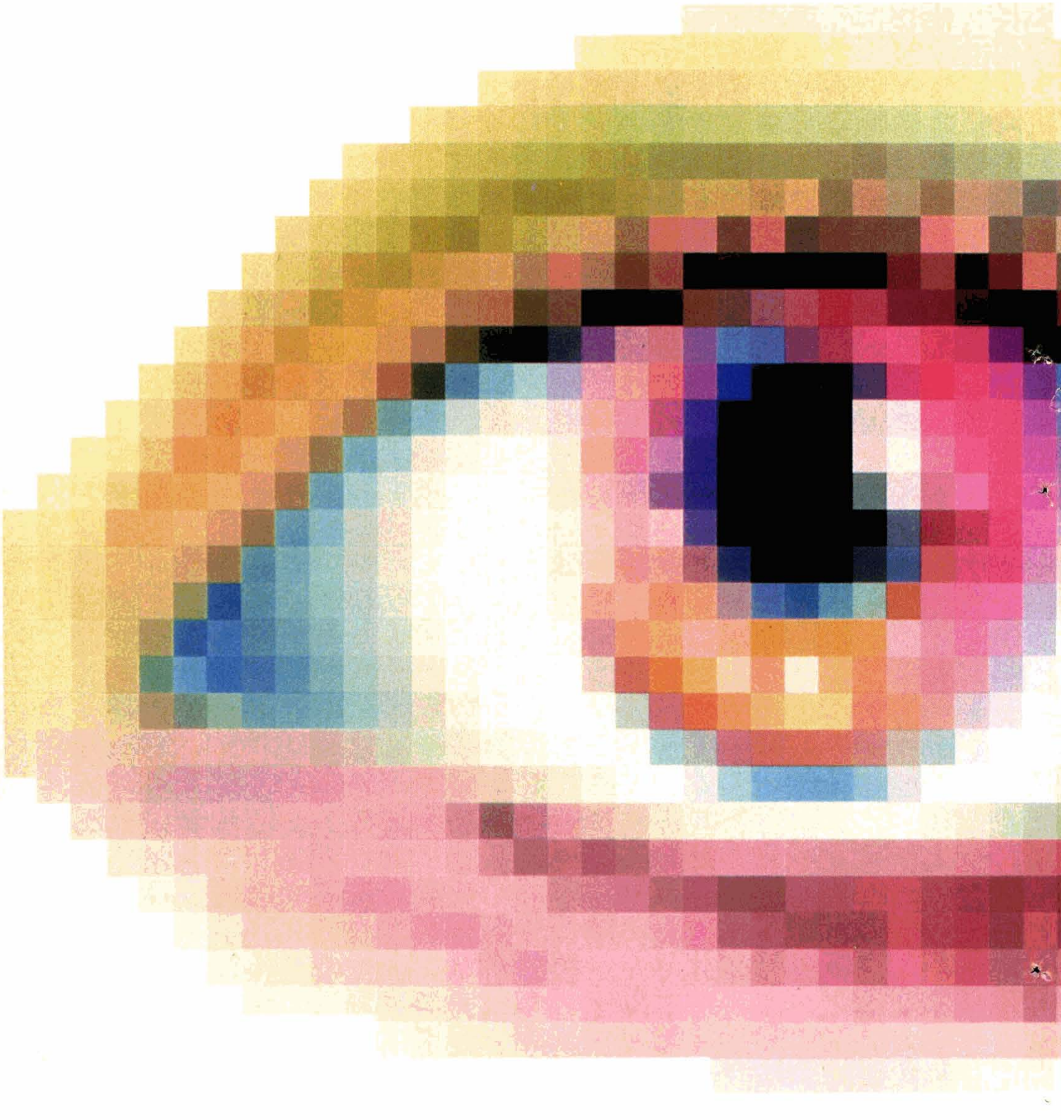

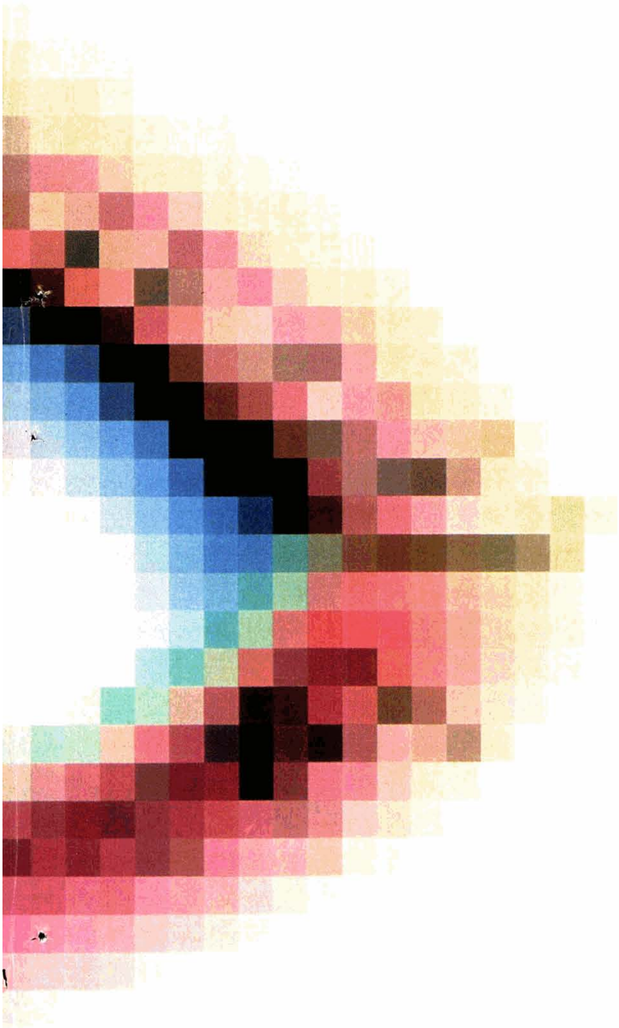

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Abstracts of Papers in This Issue

ORIGIN OF ORGANOCLAY RHEOLOGICAL PROPERTIES IN COATING SYSTEMS—S.J. Kemnetz, et al.

Journal of Coatings Technology, 61, No. 776, 47 (Sept. 1989)

Work was conducted to study the rheological properties of organoclays in various coating systems. Experiments were designed to monitor the degree of dispersion, to define the role of polar activation, and to examine the conditions under which degelation of organoclays might occur. Several conclusions regarding the behavior of dispersed organoclays in coating systems can be drawn from this study: (1) dispersion and gelation are two separate and independent phenomena, (2) a gel promotor, such as water, is required to form a hydrogen bond network between clay platelets, (3) polar activators simultaneously act as dispersants and degellants, and (4) the organoclays operating on the new self-dispersing organoclay technology display a relatively high rate of dispersion without the need for a polar activator.

SURFACE STUDIES OF TITANIUM DIOXIDE PIGMENTS—T. Losoi

Journal of Coatings Technology, 61, No. 776, 57 (Sept. 1989)

The surfaces of alumina-, silica-, and alumina-silica-coated TiO_2 pigments were studied with zeta potential (ZP), X-ray photoelectron spectroscopy (XPS), and secondary ion mass spectroscopy (SIMS) measurements. The differences in the isoelectric points (IEP) of alumina-silica-coated pigments derived from the ZP curves illustrated clearly whether the uppermost layers of the coatings were dominated by alumina or silica. The elemental compositions of surface layers obtained from XPS and SIMS experiments suggested different coating methods for pigments with similar bulk analyses. All the methods used confirmed that the hydrous oxides of Al and/or Si covered the base TiO_2 crystals instead of being loose compounds between the crystals. The surface analytical results were used in a study of dispersion stability of TiO_2 water-borne formulations.

See Pages 21-44 for

Annual Meeting & Paint Show

Information

PLASMA SURFACE TREATMENT OF POLYPROPYLENE-CONTAINING PLASTICS—K. Tsutsui, A. Iwata, and S. Ikeda

Journal of Coatings Technology, 61, No. 776, 65 (Sept. 1989)

A corona discharge treating apparatus equipped with a suspending electrode formed by several conductive and flexible pieces was constructed. This apparatus is good for uniformly treating awkwardly shaped objects. Either low-pressure plasma of O_2-containing gas or air corona discharge treatment can provide increased adhesion of top coatings to polypropylene-containing substrates. Air corona discharge treatment is, however, superior to low-pressure O_2 plasma.

X-ray photoelectron spectroscopy (XPS) analysis indicates that O_2-containing functionalities are responsible for enhancing the bond between the substrate and the top coating in both low-pressure O_2 plasma and air corona discharge treatment. Moreover, greater amounts of the O_2-containing functional groups were detected in air corona discharge treatment.

NEW HORIZONS IN COATINGS SCIENCE AND TECHNOLOGY—R.B. Seymour

Journal of Coatings Technology, 61, No. 776, 73 (Sept. 1989)

The art of making paint, which was the pioneer polymer technology, continues to be an important facet of polymer technology and is becoming more scientific. In spite of the development of many new surfaces that do not require protective or cosmetic coatings, the annual sales of paint in the U.S. is in excess of $10 billion. The volume of low-solids coatings continues to decrease, but this decrease is counteracted by an increase in the volume of water-borne and higher-solids coatings.

In spite of many new stringent regulations by EPA and related agencies, the paint industry has been able to produce modern compliance coatings. New tests that are now available enhance quality improvement and the technical stature of the paint industry. The many acquisitions of smaller firms by the leading paint producers and the establishment of new production facilities is indicative of the industry's progress. The large number of articles referred to in this review is also indicative of the vigorous activity of paint technologists in improving the stature of the paint industry.

California's Bay Area Adopts New Rule for VOC Emissions from Automotive Refinish Coatings

According to a report recently released by the National Paint and Coatings Association, Northern California's Bay Area Air Quality Management District has adopted a regulation that should reduce the Volatile Organic Compound (VOC) emissions from auto refinishing operations by nearly two-thirds over the next five years. The rule's provisions are scheduled to take effect on January 1, 1990.

Members of an NPCA-sponsored coalition of automotive refinish product manufacturers, who were instrumental in getting the rule approved, say they will try to get similar regulations adopted in other areas where VOCs from auto refinishing operations are currently regulated, or where such regulation is being considered.

The emission reductions are to be achieved through a combination of reduced solvent content in the paints applied; the use of higher transfer-efficiency spraying equipment, thus reducing overspray; and changes in the handling of surface preparation and cleanup solvents.

The rule will require the use of spray equipment with a transfer efficiency of at least 65%; that is, overspray cannot exceed 35%. Conventional air atomizing spray guns are considered to have a transfer efficiency of only 25%.

The higher transfer efficiency equipment will be mandatory by July 1990 for primer coatings, and by January 1991 for topcoats.

While the solvent content of most coatings applied will initially be lowered only slightly, lower-VOC coatings will be required by January 1992, and significant additional reductions must be made by January 1995. Conventional lacquers will be virtually eliminated as of January 1991.

According to the Air Quality Management District, the decision to defer requirements for substantially lower VOC coatings until 1992 was based on the critical need for color-matching to ensure customer satisfaction. While there are existing coatings with lower VOC content than those mandated for 1990, they have not been developed to the point where color matching in a wide range of colors can be guaranteed.

The levels mandated for 1992 will force the development of lower-VOC coatings, while the 1995 levels represent the lowest possible VOC content for automotive refinish products, according to manufacturers.

In addition to requiring lower-solvent coatings and higher transfer-efficiency equipment, the rule stipulates that surface preparation and cleanup solvents, and rags or paper soaked with such materials, must be stored in closed containers.

The District staff estimates that, at present, automotive lacquers, enamels, undercoatings, and surface preparation and cleanup solvents are responsible for 10 tons of VOC emissions per day in the Bay Area. Over five years, the new rule is expected to lower that total by 6.5 tons per day. According to NPCA's automotive refinish coalition, that figure represents a greater five-year reduction from auto refinish operations than the reduction anticipated under the more disruptive rule currently in place in Southern California.

Lilly Industrial Purchases Jamestown Coatings

Lilly Industrial Coatings, Inc., Indianapolis, IN, has acquired Jamestown Coatings Group, a division of Essex Specialty Products, Inc., a wholly-owned subsidiary of The Dow Chemical Company.

This new Lilly Industrial Coatings, Inc. subsidiary, located in Jamestown, NY, manufactures and supplies coatings for the general OEM market. It will be operated under the name Lilly Jamestown, Inc.

Larry D. Nelson will continue in his current positon as General Manager, in addition to becoming President of the new subsidiary. Raymond T. Chlodney will continue as Technical and Sales Manager and also will assume the responsibilities of Vice President.

EPA Develops Chamber for Environmental Testing

The U.S. Environmental Protection Agency has developed unique environmental exposure chambers and field facilities for testing and evaluation of materials. The chamber facilities permits the exposure of materials to controlled urban environments and other complex smog mixtures during simulated night and day cycles. Indoor environments at various levels of humidity can also be simulated in the chambers for testing materials, such as electronic components, etc. The chambers are located at the U.S. EPA's Environmental Research Center in the Research Triangle Park, NC and at North Carolina State University in Raleigh.

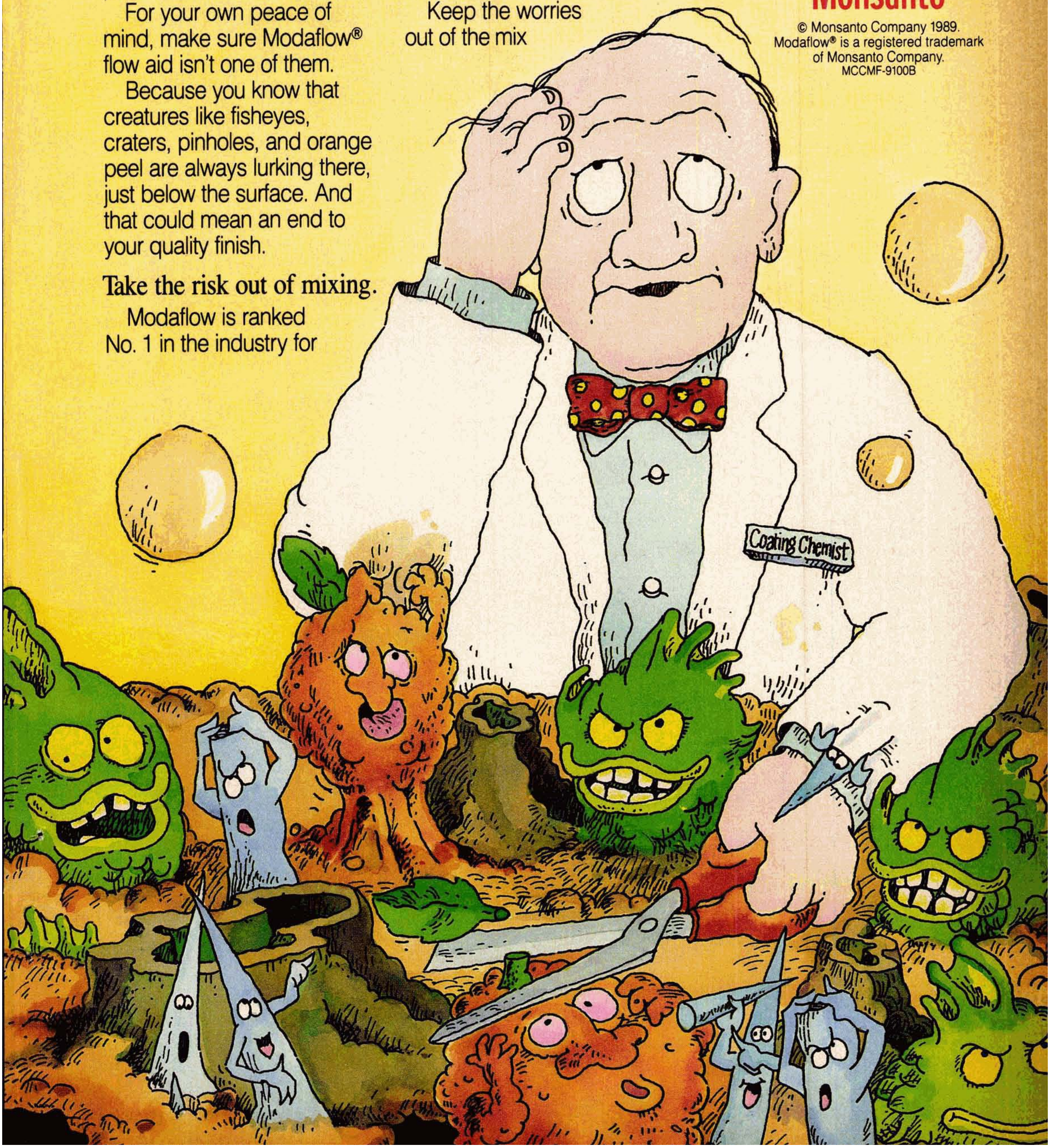
Covering spray devices that are located at environmental monitoring sites in North Carolina and Ohio have provided a means of separating the effects of gaseous and rain components of the environment during exposure of materials. Analysis of rain condensation and runoff collections from material surfaces during exposure provides early insight into the degradation process caused by environmental deposition.

The chambers and covering spray devices were developed for studying the effects of acidic deposition on metals, stone, and coated substrates during EPA's participation within the National Acid Precipitation Assessment Program. Nonfederal funding for the use of these facilities has been authorized by Congress through the Federal Technology Transfer Act of 1986, Public Law 99-502, October 1986, USC 3710A.

For further information, contact Ronald Patterson, U.S. EPA, Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC 27711.

Akzo Coatings Forms New U.S. Resins Group

Akzo Coatings Inc., Troy, MI, has formed a new U.S. Resins Group that will be part of the Coatings and Resins Division of the firm. Akzo currently has four resin-producing operations in the United States, including: LanChem, located in East St. Louis, IL, which produces resins for both coatings and printing inks; S-R Premier, a producer of printing ink vehicles based in Addison, IL; Iovite, in Matteson, IL, a producer of vehicles and resins for printing inks; and Akzo Coatings Inc (formerly FRP Co.), located in Baxley, GA, a producer of synthetic rosin and hydrocarbon-based resins, and gum rosin.


Coating Chemist

Study Projects European Coatings Industry Growth Rate to Be at 2% Annually

According to a report issued by Chemark, of Cincinnati, OH, the projected growth rate of the industrial coatings market in western Europe is predicted to be only 2% per year. Although analysis of this data leads to the opinion that this market is slow growing, underlying dynamics provide additional information. Some parts of the industry are growing quickly, while others are declining rapidly.

On one hand, conventional, low solids, solvent-borne coatings are declining rather rapidly in favor of a myriad of compliant technologies. However, the use of technologies such as radiation curing or emulsions and latexes is growing at 10% or more per year.

Compliant technologies have taken a dominant position in the western European marketplace. Nearly 60% of the coatings used in 1988 were applied via compliant technologies. The study predicts that, by 1997, that figure should exceed 75%.

By contrast, it will be 1994 before compliant technologies are used to apply 60% of the industrial coatings in the U.S. A compliant technology is one which readily conforms to VOC standards without expensive solvent reclamation.

The study further reports that there are over 350 opportunities in the European coatings marketplace. A growth opportunity was defined as a product which is expected to grow by at least 5% per year between 1987 and 1992, from a usage of at least 200,000 dry gallons in 1987.

Over 220 emerging technologies were identified in the study. An emerging opportunity must also be expected to grow by at least 5% per year, but less than 200,000 dry gallon usage in 1987.

For more information, contact: Chemark, 9916 Carver Rd., Cincinnati, OH 45242, or in Europe: Beethovenstrasse 7b, 6000 Frankfurt/M. 1, West Germany.

DeSoto Offers Analytical Services to Independent Firms

DeSoto, Inc., Des Plaines, IL, is now offering the services of its Analytical Research Group to those companies who use or manufacture coatings and polymers. The firm's Analytical Services Group was established as an in-house facility in 1959. Since that time, independent firms have explored the possibility of using the group's services on a project basis.

Areas of specialty include: infrared spectroscopy, gas chromatography, nuclear magnetic resonance spectroscopy, gas chromatography-mass spectrometry, electron microscopy, and mechanical analysis. In addition, the team has the ability to analyze oil, rubber, plastics, additives, metals, catalysts, and general chemicals.

For more information, contact DeSoto at Box 5030, 1700 S. Mt. Prospect Rd., Des Plaines, IL 60017.

Local Associations and Paint Industry Launch Cooperative "PIP" Efforts

The Wisconsin Paint & Coatings Association kicked-off its 1989 "Picture It Painted" Campaign by joining the City of Milwaukee in transforming a vacant, three-story building into apartments for homeless women and children. The Wisconsin paint industry donated paint, labor, and sundries to renovate the interior as well as the exterior trim of the 18-unit facility.

The building is owned by the local YWCA, and will operate as long-term transitional housing once the renovation has been completed. In addition to providing temporary housing, the YWCA will offer its residents a number of services, such as day-care, educational courses, and career and employment training.

Wisconsin PCA will continue its community-improvement activities by launching its third consecutive citywide anti-graffiti youth program in conjunction with the City of Milwaukee. Other PIP efforts include ongoing paint donations to the Wisconsin Correctional Services to renew homes of the elderly and disabled, and the 1988 interior renewal of family abuse centers in Oskosh and Kenosha.

In addition, The Louisville Paint & Coatings Association brought a colorful makeover to the Wayside Christian Mission, an emergency shelter for the homeless, in a one-day effort recently. The Louisville PCA sponsored the project in conjunction with the Louisville Chapter of the Painting & Decorating Contractors of America and Local 118 of International Brotherhood of Painters and Allied Trades. The combined groups have sponsored at least eight other community improvement projects, including a face-lift for the Home of the Innocents at St. Martin School, a school for homeless and medically-fragile children; the Cabbage Patch Settlement House, a nonprofit facility that provides family-oriented services; Cedar Lake Lodge, a home for the mentally retarded; a block of the inner-city homes in the California District; and City Hall.

ASTM Expands Appearance Terminology Standard

ASTM standards-writing Committee E-12 on Appearance of Materials, and its Subcommittee E12.01 on Definitions and Terminology, have announced the expansion of ASTM Standard E 284, Definitions of Terms Relating to Appearance of Materials.

Until this expansion, E 284 contained approximately 209 terms. The standard now includes 443 terms, with another 22 terms being balloted for consensus approval. E 284 is widely used when definitions are required for terms relating to color, gloss, opacity, texture, fluorescence, retroreflection, and other geometric and spectral aspects of appearance.

Committee E-12 welcomes comments and suggestions for new terms or revised definitions that will allow E 284 to better serve the appearance field. Comments should be addressed to Sharon Kauffman, ASTM, 1916 Race St., Philadelphia, PA 19103. For copies of the expanded standard, contact ASTM Customer Services at the same address. Additional information is available from Subcommittee Chairman Fred W. Billmeyer, Jr., 2121 Union St., Schenectady, NY 12309.

Alcan Acquires Interest In Handy Chemicals

Alcan Chemicals, a division of Alcan Aluminium Limited of Montreal, has acquired from Domtar Inc. of Montreal, their 50% interest in Handy Chemicals Ltd.

Handy Chemicals, a specialty chemical manufacturer with operations in La Prairie, Quebec, and Vancouver, B.C., produces superplasticizers for the concrete industry and flocculants for water treatment and the pulp and paper industry.

JONCRYL® 530
JONCRYL® 537
JONCRYL® 538
NEOCRYL® A-633
NEOCRYL® A-639
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RHOPLEX® WL-92
RHOPLEX® WL-96
RHOPLEX® AC-604

The best coalescers for the new, hydrophobic acrylic resins aren't glycol ethers.

They're Exxate® alkyl acetates.

If you are formulating water-borne coatings with any of the newer, harder, hydrophobic acrylic resins, you should know that hydrophobic Exxate alkyl acetates offer many important advantages over hydrophilic glycol ethers traditionally used as coalescing agents.

Proven coalescing power

Exxate alkyl acetates are powerful coalescers, as demonstrated by measured minimum film-forming temperatures (MFT's). In tests using Joncryl® 530, Neocryl® A-633, and Rhoplex® WL-91 resins, Exxate alkyl acetates had lower MFT's than the glycol ethers, especially at lower concentrations. Exxate alkyl acetates are essentially water immiscible, so they partition almost entirely into the exterior latex phase instead of the outer aqueous phase, providing excellent coalescing action.

Improved corrosion resistance

Exxate alkyl acetates impart excellent corrosion resistance to coating formulations applied to metal substrates. Because it is water immiscible, the retained Exxate solvent does not attract water, thereby eliminating one of the major corrosion mechanisms.

Better evaporation rate control

With six grades to choose from, Exxate alkyl acetates provide a wide range of evaporation rates for air-dry formulations. By choosing the appropriate Exxate grade or by blending different grades, you can easily adjust the evaporation rate of a solvent mixture to prevent solvent kick-out in high-humidity conditions.

Excellent film properties

Exxate alkyl acetates have lower surface tensions than tested glycol ethers and can improve wetting, surface texture, gloss and film adhesion.

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With Exxate alkyl acetates you avoid the toxicity concerns associated with some glycol ethers. Exxate solvents have a low order of acute and subchronic toxicity. Teratological and ecological testing demonstrate minimum risk to human health and environment.

Full technical details

Complete information on tests and comparative properties of Exxate alkyl acetates and glycol ethers are yours for the asking. Call your Exxon Chemical sales representative or contact Jackie Reynolds, Market Development Specialist, at Exxon Chemical Company, Box 3272, Houston, Texas 77253-3272. Phone 713/870-6377.

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CHEMICAL

CMA Honors Firms for Safety Records

Dow Corning Corp, Midland, MI, and Weyerhaeuser, Co., Chemical Business, Tacoma, WA, were recently honored by the Chemical Manufacturers Association for their outstanding safety records.

The awards are made to CMA member companies which have shown, in their respective size categories, the greatest percentage reduction in their 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 year must not exceed the average for all companies in the same category.

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

There was no winner in the "large" company category this year. Dow Corning received the award as mid-size company winner and Weyerhaeuser Co. won in the small company category.

In addition, the Chemical Manufacturers Association honored Witco Corporation for its 50 years membership in the association.

ASTM's New Subsidiary Launches First Project

The first project sponsored by the ASTM Institute for Standards Research (ISR) was launched recently. ISR is a separate not-for-profit corporation established by ASTM in 1988 to sponsor standards-related research. ISR does no research itself, but serves as the intermediary between the standards-writing community and the public or private agencies that provide appropriate research and technical services or supply funding for such research.

The project, submitted by ASTM Committee E-5 on Fire Standards, involves a major international interlaboratory testing program to validate two established and three proposed ASTM fire test methods. The International Organization for Standardization Technical Committee 92 on Fire Standards is also joining the project by participating in the round robins for the three proposed test methods. Through the joint cooperation of Committee E-5 and ISO TC 92, the fire test community will not only have precision and bias measurements for these five tests, but also the first opportunity for direct comparison of the test data between the various fire tests in use throughout North America and Europe. The resulting standards could ultimately reduce testing costs for manufacturers exporting products to Europe.

Pacific Scientific Color Line Purchased by BYK-Labotron

BYK-Chemie GmbH, headquartered in Wesel, West Germany, has purchased the Color and Appearance product line (formerly known as Gardner Laboratory) of the Instrument Division of Pacific Scientific Company, Inc., Newport Beach, CA. The wholly-owned subsidiary of BYK-Chemie, BYK-Labotron, facilitated the acquisition.

The result of this purchase will be a new company named BYK-Gardner, Inc. with facilities located in Silver Spring, MD.

The primary business of the newly acquired firm is the designing, manufacturing, and distributing of opto-electronic and mechanical instrumentation for measuring the color, appearance, and physical properties of products used and produced by the coatings, plastics, food, automotive, chemical, and other industries.

Battelle Initiates Multiclient Program For Packaging Materials and Processes

A new international program designed to help clients anticipate and prepare for packaging needs in the 1990s has been initiated by Battelle, Columbus, OH. The multiclient program, "Packaging Materials and Processes for the Future," will identify new materials and material processing methods that will impact the packaging industry during the next decade.

Technological innovations in polymers, metals, paper and paperboard, ceramics, and composites will be examined in relation to changing demographics, life styles, microwave cooking, environmental issues, and controlled atmosphere and modified atmosphere developments.

The program involves a variety of packaged products including foods, beverages, and industrial and commercial items. Already supported by more than 20 companies from the U.S., Europe, and Japan, subscribers currently including material suppliers, package converters, and end users.

After the program's completion, subscribers will receive a report describing: principal drivers influencing the packaging industry; emerging, application-oriented developments; and features of specific innovative materials and processing methods that will challenge or supplement currently available materials and processes. In addition, the project will provide a basis for planning packaging reserach and development, reducing material costs through use of alternative materials, and designing concepts for packaging that meet environmental concerns.

The 12-month program, which began in June 1989, is still open to subscribers. For more information, contact Joseph Wray, Battelle, 505 King Ave., Columbus, OH 43201-2693.

Union Carbide Aligns Silicones Businesses

The Specialty Chemicals Division of Union Carbide Corporation has organized its silicone fluids and silicone surfactants and silanes businesses into a new worldwide unit designated the OrganoSilicon Products, Systems and Services Group (OSi).

The products of OSi are used in markets such as fiberglass reinforced plastics, textiles, coatings, automotive, chemical specialties, pharmaceutical, thermoplastics, adhesives, sealants and other specialty markets. Key international areas are Europe, Japan, Brazil, the Asia Pacific region, Canada, and Mexico. To support this activity, the company plans expansion of amino, methacrylate, and epoxy silanes at the division's Sistersville, WV plant and a previously-announced expansion of its production facilities in Itatiba, Brazil.

Named to director posts in OSi in the United States are: Duane F. Baumert, Director of Marketing and Sales Services; Thomas P. Leyden, Worldwide Business Director; Dr. Jerry R. Barber, Director of New Business Technology and Development; Dr. E. Larry Jarrett, Director of Research and Development; and Mr. Lynn W. Phair, will continue as Plant Manager at Sistersville.

Reichhold to Relocate To North Carolina

Reichhold Chemicals, Inc., White Plains, NY, has announced its intent to build a consolidated research and office facility in the Raleigh-Durham-Chapel Hill Research Triangle in North Carolina. Corporate headquarters, research and development laboratories, and division headquarters for three divisions—Reactive Polymers, Coating Polymers & Resins, and Emulsion Polymers—will be relocated to the new facility by early 1991. Swift Adhesives and Reichhold Limited will not be affected by this move.

Regulatory UPDATE

SEPTEMBER 1989

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 Roy F. Weston, Inc., Washington, D.C.

Food and Drug Administration (FDA) Proposed Ban on Red Dye No. 3 Delayed by Congress—A report accompanying an agriculture appropriations bill that was recently passed by the U.S. House of Representatives called for further study of Red Dye No. 3 before the food additive is banned as a cancer-causing substance.

However, the report calling for more study does not require the FDA to leave the dye on the market. The dye, and a number of substances, were originally put on a provisional listing in 1962, which allowed the substances to stay on the market for two additional years while additional studies were conducted. Since then, the provisional listing has been extended many times. (See Congressional Record, July 18, 1989, also August 1989 FSCT *Regulatory Update*).

HR 2585—Air Toxics Control Act of 1989—Rep. Waxman (D-CA):

- Mandates technology-based controls for regulation of 187 air toxics. EPA could add to and delete from this list by its own actions or in response to petitions by others.
- EPA also would be required to list all categories of major sources within 12 months after enactment. The bill has a tight schedule for establishment of standards for the list of major sources, with standards set for 100% of the categories within eight years.
- EPA will set best available control technology (BACT) standards requiring the maximum achievable degree of reduction for each air toxic substance as determined by EPA, taking into account cost, nonair quality health and environmental impacts, and energy requirements. These standards will be reviewed every five years.
- Under the BACT, the minimum degree of reduction for each source under the BACT must not be less than the largest reduction achieved in practice by a major emitter in the same category. In figuring the minimum reduction, EPA can exclude 10% of major facilities with the lowest emission rates.
- If EPA does not set a standard within six months of the lapsed deadline, facilities will be subject to an emission standard which requires the greatest degree of emission reduction achieved in practice by a major facility in that category.
- Requires even more stringent limits to reduce residual risk.
- EPA would set new regulations to prevent and detect accidental releases. Establishes new accidental release program requiring risk management plans by industrial facilities. Industry also would be required to develop effective responses to accidental releases.

California Prop 65—Recent Developments—The United States Office of Management and Budget (OMB) recently refused to change a prior finding that Prop 65 does not pre-empt federal laws. OMB reiterated its position in a letter from OMB Administrator for Information and Regulatory Affairs S. Jay Plager to the FDA Commissioner Frank Young, Chairman of a White House task force. The task force was set up under the White House Domestic Policy Council specifically to study Prop 65. This was in response to the efforts of The Grocery Manufacturers of America beginning in 1987 to overturn key provisions of Prop 65.

EPA Promulgates Widespread Ban on Asbestos—EPA, under authority from the Toxic Substances Control Act (TSCA), section 6, has issued a final rule to prohibit the future manufacture, importation, processing, and distribution in commerce of asbestos. This ban, which takes place in intervals, is applicable to almost all products. See 54 Federal Register 29460 (July 12, 1989).

The final rule also requires products containing asbestos that are subject to the ban be labeled to promote compliance with and enforcement of the rule. Exemptions from the rule can be granted by EPA in very limited circumstances. The effective date of the rule was August 25, 1989, and Stage 1 banning such products as flooring felt, vinyl/asbestos floor tile, and asbestos clothing starts in August 1990.

For more information, contact Michael M. Stahl, Director, TSCA Assistance Office, (TS-799), Office of Toxic Substances, U.S. EPA, Room EB-44, 401 M Street, S.W., Washington, D.C. 20460, (202) 554-1404.

HR 2323—Clean Air Restoration Act—Rep. Waxman (D-CA):

- Introduced by bipartisan coalition and co-sponsored by over 100 House members.
- Focuses on reducing ozone, particulars, and carbon monoxide from mobile and stationary sources.
- Requires automotive vehicles to meet emission standards for 10 years or 100,000 miles after EPA certification. Includes alternate fuels program.
- Areas that fail to meet the ozone standard would be divided into four categories based on their efforts to comply. The categories are: moderate, serious, severe, and extreme. Compliance deadlines are extended by 4, 8, 12, and 16 years for the respective categories.
- Although more time is given to meet the ozone standard, more aggressive pollution control measures would also be required.

EPA Requests Additional Comments on Comprehensive Assessment Information Rule (CAIR)—EPA is requesting comments on additional issues relating to CAIR that have been raised by industry groups since the first proposal of the rule in December 1988. The CAIR is a rule that standardizes information collection by EPA on chemicals substances. See 54 Federal Register 30211 (July 19, 1989), also see February and April 1989 FSCT *Regulatory Updates*).

The additional issues include: consideration of adding a small volume exemption; possible inclusion of a concentration exemption, thereby establishing a *de minimis* cutoff for CAIR substances in mixtures; comments on how compliance with CAIR can occur without releasing confidential business information; whether a Question and Answer document would clear up confusion about the definition of process and processing activities; and finally whether there are options for advance substantiation of confidential business information claims.

Comments are due by September 19, 1989, to Docket Number OPTS-82013F. An original and two copies should be sent to: TSCA Public Docket Office, (TS-793), Office of Toxic Substances, U.S. EPA, Room NE-G004, 401 M. Street., S.W., Washington, D.C. 20460.

For further information, contact Michael M. Stahl, Director, TSCA Assistance Office, Office of Toxic Substances, U.S. EPA, Room E-545, 401 M Street., S.W., Washington, D.C. 20460, (202) 554-1404.

Clean Air Act Legislative Proposals—The following legislative proposals affecting paint and coatings have been summarized, with particular focus on air toxics and ozone reduction provisions.

- Administration bill—not yet introduced into Congress, expected to be sponsored by House Energy and Commerce Chairman Dingall (D-MI). Specific provisions could change as actual legislative language is developed.
- Acid rain/ozone: requires 40% reduction for hydrocarbons and 30% for nitrogen oxide, and a reduction in summertime volatility of gasoline.
- Ozone: cities granted extensions in complying with the federal ozone standard would be required to take steps to reduce emissions of ozone precursors by 3% per year through fuel and alternative fuel-burning vehicle programs. Regions could opt out of fuel and vehicle programs if they can demonstrate that they will be able to comply with the federal ozone standard by other means.
- Ozone: other proposals include limiting emissions from hazardous waste treatment, storage and disposal facilities, regulating volatile organic compounds (VOC) emissions from small sources and consumer solvents and paints, and developing control technology guidelines (CTGs) for more types of major factories and plants.
- Air toxics: emissions will be reduced by technology-based controls set by EPA for sources of airborne air toxics. As originally proposed, the controls would be maximum available control technology (MACT). The EPA would be required to publish MACT regulations to control 10 source categories within two years, 25% of source categories within four years, 50% within seven years, and all categories within 10 years.
- Some small plants would be exempt from the MACT controls, and large facilities could be exempt if they had already reduced most air toxics emissions by voluntary reduction. The facilities would be given credit for those reductions against the MACT requirements.
- Additional controls would be set by EPA after assessing remaining cancer risks after MACT implementation. The additional standards allow for consideration of cost, technical feasibility, and health-based risk to prevent public exposure to "unreasonable" risk.

Interagency Testing Committee (ITC) Adds No Chemicals to List for Priority Consideration—In its 24th report, the ITC added no chemicals to the list of chemicals for priority consideration by the EPA Administrator. The ITC did remove one chemical, diisodecyl phenyl phosphite (PDDP), from the priority list because EPA has issued a testing consent order requiring testing of PDDP under the Toxic Substances Control Act (TSCA). See 54 Federal Register 31245 (July 27, 1989).

Comments were due by August 28, 1989, to Docket Number OPTS-41031, TSCA Public Docket Office, (TS-793), Office of Toxic Substances, U.S. EPA, Room NE-G004, 401 M Street, S.W., Washington, D.C. 20460.

For further information, contact Michael M. Stahl, Director, TSCA Assistance Office, (TS-799), Office of Toxic Substances, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 554-1404.

National Toxicology Program Schedules Substances for Peer Review—The National Toxicology Program (NTP) has scheduled over 40 substances for peer review beginning in November 1989. See 54 Federal Register 32130 (August 4, 1989). The substances include methyl bromide, vinyl toluene, as well as many dyes, including D&C Yellow No. 11, C.I. Acid Red 114, C.I. Direct Blue 15, etc. The notice lists the study scientist, the exposure level of the test being reviewed, and the type of route and species studied.

For more information, contact the National Toxicology Program Public Information Office, MD B2-04, P.O. Box 12233, Research Triangle Park, NC 27709, (919) 541-3991.

Occupational Safety and Health Administration (OSHA) Sets Occupational Exposure to Lead Limits—OSHA has published its statement of reasons why it believes that its recently promulgated permissible exposure limit (PEL) for lead is both economically and technologically feasible. OSHA was required to do this when the U.S. Court of Appeals for the District of Columbia remanded the record to OSHA and required OSHA to reconsider the feasibility of the PEL for certain industries. See 54 Federal Register 29142 (July 11, 1989).

The industries are brass and bronze ingot production, independent battery breaking, lead chemicals, lead chromate pigments, leaded steel, nonferrous foundries, secondary copper smelting, shipbuilding and ship repair, and stevedoring. The PEL set for exposures to lead in these industries is 50 micrograms per cubic meter of air, as specified in the lead standard (29 CFR 1910.1025).

OSHA had to consider the economic and technical feasibility of meeting the lead PEL through engineering and work practice controls in the specified industry sectors. OSHA has determined that the standard is both economically and technologically feasible in eight of the nine industry sectors because exposure levels above the PEL can be controlled within the time period permitted for compliance. For some operations within certain industries, OSHA has recommended the use of respirators for supplemental protection. For nonferrous industries, OSHA has determined that although the PEL is technologically feasible, the economic impact would contribute to the withdrawal of as much as 50% of the small foundries. Since small foundries make up as much as 60% of the nonferrous industry, OSHA has concluded that achieving the PEL through engineering and work practice controls is economically not feasible.

Compliance dates and start up dates for individual industries is set forth in *Table* 1 of 20 CFR 1910.1025, paragraph (e) and (r). For more information, contact James F. Foster, Office of Information and Consumer Affairs, Occupational Health and Safety Administration, U.S. Department of Labor, Room N-3647, 200 Constitution Avenue, N.W., Washington, D.C. 20210, (202) 523-8148.

EPA Promulgates Revisions to Significant New Use Rule Under Toxic Substances Control Act (TSCA)—EPA has promulgated revisions to TSCA's Significant New Rule (SNUR) which standardizes significant new uses and recordkeeping requirements which can be cited in SNURs applicable to individual substances. See 54 Federal Register 31298 (July 27, 1989).

The revision also establishes an expedited process for promulgating SNURs for certain new chemical substances, as well as EPA consideration of requests from interested parties to amend or revoke SNURs. The new process applies to: new chemical substances or which EPA has issued orders under section 5(e) of TSCA; other new chemical substances for which no section 5(e) orders have been issued, but which may present hazards if exposures or releases are significantly different than as described in the Pre-Manufacturing Notice (PMN).

Section 5 (a) of TSCA authorizes EPA to designate a use of a substance as a significant new use by issuing a SNUR after EPA has evaluated relevant factors, such as projected volume of production, projected change in exposures, and methods of manufacture of the substance. Also under Section 5, persons must submit to EPA a significant new use notice at least 90-days before the person manufactures, imports, or processes a substance for a significant new use.

The new revisions are effective October 10, 1989. For further information, contact Michael M. Stahl, Director, TSCA Assistance Office, (TS-799), Office of Toxic Substances, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 544-1401.

EPA Proposes Deletion of Six Substances From Extremely Hazardous Substances List (Community Right-to-Know)—EPA is proposing to delete six substances from the extremely hazardous substances list under the Emergency Response and Community Right-to-Know Act. See 54 Federal Register 30700 (July 21, 1989).

The six substances are:

Chemicals	Cas No.
dimethyl sulfide	75-18-3
isopropyl formate	625-55-8
methyl disulfide	624-92-0
phenol, 2,2"-thiobis (4,6-dichloro-)	97-18-7
piprotal	5281-13-0
sodium pentachlorphenate	131-52-2

Comments were due August 21, 1989 to, Chemical Emergency Preparedness and Prevention Office, Superfund Docket Clerk, Attention: Docket Number 300PQ, Room 2427 Mall, U.S. EPA, Mail Stop OS-240, 401 M Street, S.W., Washington, D.C. 20460.

For further information, contact Kathleen Bishop, Chemical Emergency Preparedness and Prevention Office, OS-120, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-7912.

EPA Publishes Technical Amendments to Testing Guidelines—EPA has issued as a final rule several technical amendments to the testing rules under the Toxic Substances Control Act (TSCA). See 54 Federal Register 29715 (July 14, 1989).

EPA is correcting concentrations of dimethyl formimade or acetone carriers that should not be exceeded during the test and the test temperature for gluegill, fathead minnows, and rainbow trout currently designated in section 797.1400. EPA is also correcting the solid/solution ratio for a test chemical in sediment or soil.

The amendments were effective July 14, 1989. For more information, contact Michael M. Stahl, Director, TSCA Assistance Office, (TS-799), Office of Toxic Substances, U.S. EPA, Room EB-44, 401 M Street, S.W., Washington, D.C. 20460, (202) 554-1404.

HR 99—Clean Air Act Amendments of 1989—Group of Nine:

- The Group of Nine are nine moderate Representatives supporting compromise Clean Air Act legislation.
- Requires states to conduct enhanced monitoring of ozone, nitrogen oxide, VOCs, and carbon monoxide. Major stationary sources could be required to submit annual emission monitoring report if emissions exceed 25 tons annually.
- Ozone: categorizes current nonattainment areas into moderate, serious and severe, based on the degree of nonattainment. Deadlines for compliance with the federal ozone standards are extended 3 to 13 years.
- Establishes a fee of $25 per ton of VOC or nitrogen oxide emitted from defined major sources per calendar year.
- Ozone: requires State Implementation Plan (SIP) revisions containing Federally prescribed measures which increase in severity with the categories as described above. Some of the provisions include: offsets for construction or modification of a stationary source; reasonably available control technology (RACT) for all stationary sources for all categories; alternative fuels program; for the most severe areas, lowest achievable emission rate (LAER) and set reductions in VOC emissions per calendar year; and increased development and enforcement of Control Technology Guidelines (CTGs), specifically for aerospace coatings.

HR 4—The Clean Air Act Amendments of the 101st Congress—Rep. Dingall (D-MI):

- Focuses on air toxics.
- Establishes an air toxics list of 187 substances, which EPA can add to or delete from by its own actions or in response to petitions by others.
- Requires EPA to establish a list of all major categories of stationary sources, and must designate 50% of the list for regulation according to a strict schedule for standard setting. Emission standards for 10% of the source categories must be promulgated within two years after enactment, 50% of all source categories must have standards within four years, an additional 50% must have standards within seven years, and all categories must have standards within 10 years.
- After a category has had standards promulgated for seven years, EPA will evaluate risks remaining to the public health and if these risks are significant or have potential to result in serious widespread adverse effects on public health, EPA will set standards requiring additional emissions reductions of 90% within two years.

S 816—Toxics Release Prevention Act of 1989—Sen. Durenberger (D-MN):

- Major air toxic emitters—those with 10 tons emissions or more annually—must use best available control technology (BACT) to limit emissions. EPA can take cost into account in setting BACT. If a source reduces its toxic air emissions by more than 90% by 1993, technology based standards are not required for the source.
- Risk factors would be established for particular chemicals, and if the technological controls (e.g., BACT) are found by EPA to be inadequate for control of the risks posed by the substances, EPA would be required to impose a more stringent, health-based standard on the sources.
- EPA would be required to establish a national air toxics strategy for controlling emissions from mobile sources (e.g., cars and trucks) as well as stationary sources like dry cleaners, gas stations, and other small sources.
- To reduce the likelihood of catastrophic accidents, the bill would require review of facilities that handle 50 listed extremely hazardous substances, and establishment of a chemical safety board to investigate accidents and make recommendations for preventative measures.

National Toxicology Program Published Technical Reports—The National Toxicology Program (NTP) has published several technical reports:

Substance	Evidence of Carcinogenicity
(TR335) C.I. Acid Orange 3	Clear evidence in female rats, no evidence in male rats, male or female mice
(TR349) Technical-grade pentachlorophenol (2 Mixtures)	
—technical grade	Clear evidence in male mice, some evidence in female mice
—EC-7	Clear evidence in male and female mice
(TR345) Roxarsone	Equivocal evidence for male rats, no evidence for female rats or male/female mice

For free copies of the Technical Reports, contact the National Toxicology Program Public Information Office, MD B2-04, P.O. Box 12233, Research Triangle Park, NC 27709, (919) 541-3991. See 54 Federal Register 29392 (July 12, 1989).

EPA Proposes Revision of Protection of Stratospheric Ozone Regulations—EPA is proposing amendments to the regulations that implement the Montreal Protocol, an international treaty that requires ratifying countries to limit their production and consumption of substances that are known to deplete stratospheric ozone. EPA is proposing these amendments because several sections reflect how the United States interpreted the terms of the Protocol at the time of promulgation. Since then several parties to the agreement have met to resolve issues of interpretation. See 54 Federal Register 29353 (July 12, 1989).

The proposed amendments changes how persons may obtain authorizations to convert potential production allowances to actual production allowances. The proposed amendments say that authorizations to convert may be granted only with proof of export to parties operating under certain sections of the Protocol or upon proof of transfer of production rights from another party. Three of the proposed amendments increase the recordkeeping and reporting for affected persons.

A public hearing was held on July 27, 1989, on the proposed amendments, and written comments were due by August 11, 1989, to Docket No. A-87-20 (Amendments), Air Docket Room M-1500, Waterside Mall, 401 M Street, S.W., Washington, D.C. 20460. For further information, contact David Lee, Analyst, Office of Atmospheric and Indoor Air Programs, Division of Global Change, Office of Air and Radiation, (ANR-445), U.S.

Food and Drug Administration (FDA) Grants Food Additive Petitions—The FDA has granted a food additive petition by E.I. du Pont de Nemours and Co. and has changed its regulations to allow for the safe use of a Nylon 6I/6T polymer manufactured by the condensation of hexymethylenediamine, terephthalic acid and isophthalic acid for contact for all types of food except beverages containing 8% alcohol. This amendment was effective July 11, 1989, and written objections and requests for hearings were to be filed by August 10, 1989 to the address below. See 54 Federal Register 29018 (July 11, 1989.)

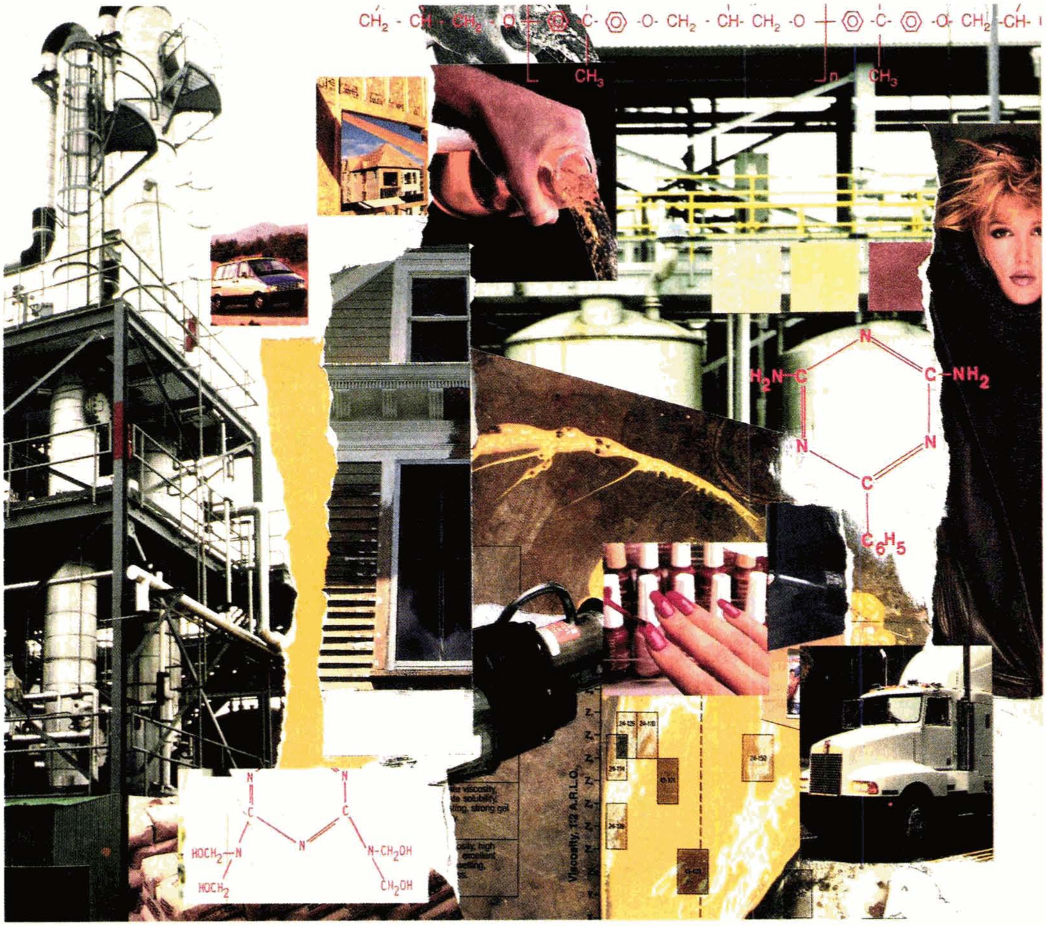
For more information, contact Edward J. Machuga, Center for Food Safety and Applied Nutrition, (HFF-335), Food and Drug Administration, 200 C Street, S.W., Washington, D.C. 20460, (202) 472-5690.

The FDA also granted a petition by BYK-Chemie GmbH and has changed its regulations to allow for the safe use of siloxanes and silicones, dimethyl,3-hydroxypropyl group-terminated, diesters with poly(2-oxepaneone), diacetates as components for articles in contact with food. This amendment was effective July 24, 1989, and written objections and requests for hearings were to be filed by August 23, 1989. See 54 Federal Register 30731 (July 24, 1989.)

For more information, contact Richard H. White at the above address and telephone number. Written objections on either of these amendments should be sent to, Dockets Management Branch, (HFA-305), Food and Drug Administration, Room 4-62, 5600 Fishers Lane, Rockville, MD 20857.

SUMMARY CALENDAR OF REGULATORY ACTIONS

July 10, 1989	FDA grants food additive petition. Adverse comments were due by August 10, 1989. (See this issue.)
July 24, 1989	FDA grants food additive petition. Adverse comments were due by August 23, 1989. (See this issue.)
August 11, 1989	Comments were due to EPA on proposed changes in Stratospheric Ozone Regulations. (See this issue.)
Ausust 21, 1989	Comments were due to EPA on deletion of six substances from Extremely Hazardous Substances List. (See this issue.)
September 11, 1989	Comments due on EPA Draft Guidance on Waste Minimization. (See August 1989 issue.)
September 19, 1989	Comments due to EPA on additional issues of the Comprehensive Assessment Information Rule (CAIR). (See this issue.)
October 3, 1989	Comments due to OSHA on increased use of respiratory protection for compliance with worker exposure. (See July 1989 issue.)
October 10, 1989	Technical amendments to TSCA Significant New Use Rule (SNURs) Regulations effective. (See this issue.)
January 1, 1990	New Jersey limits on VOC content on architectural coatings effective. (See May 1989 issue.)
October 26, 1990	UST financial assurance requirements deadline for nonpetroleum marketing companies with a net worth of less than $20 million. (See May 1989 issue.)



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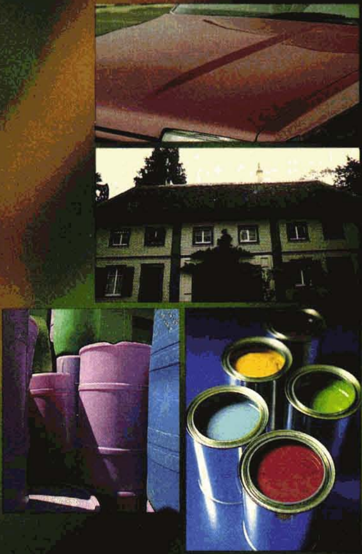

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Federation of Societies for Coatings Technology

67th Annual Meeting ★ 54th Annual Paint Industries' Show

Preliminary Program

The New Orleans Hilton ★ The Rivergate
Wednesday, Thursday, Friday ★ November 8, 9, 10, 1989
New Orleans, Louisiana

Preliminary Program

"Coatings Worldwide: Meeting the Needs Of the Nineties"

WEDNESDAY, NOVEMBER 8

OPENING SESSION*
(9:00)

Sixty-Seventh Annual Meeting of the Federation of Societies for Coatings Technology opened by President James E. Geiger

Invocation and In Memoriam

Welcome: Kenneth W. Espeut, President of Southern Society for Coatings Technology

Thad T. Broome, Chairman of the Host Committee

George R. Pilcher, Chairman of the Program Committee

John A. Lanning, Chairman of the Paint Industries' Show Committee

Introduction of Distinguished Guests

E.W. FASIG KEYNOTE ADDRESS*

A Look at the Bush White House—Larry Speakes, Author, Lecturer, TV Commentator, and formerly Chief Spokesman for the Reagan Administration (1981-87)

***Note**: Opening Session and Keynote Address will be presented in the Grand Ballroom of the New Orleans Marriott Hotel. All other sessions to be held in the New Orleans Hilton

PROFESSIONAL DEVELOPMENT COMMITTEE SYMPOSIUM ON ADVANCED TOPICS IN COATINGS RESEARCH
(2:00-4:30)
Napoleon Ballroom

Moderator—Dr. Richard J. Himics, President, Daniel Products Co., Jersey City, NJ

Collaboration—A European Approach to Research—J.A. Bernie, Managing Director, The Paint Research Association, Teddington, Middlesex, England

Lasers, Light, and Liquid Crystalline Thin-Film Coatings—Prof. Charles H. Hoyle, Marty A. Trapp, and Chander P. Chawla, Dept. of Polymer Science, University of Southern Mississippi, Hattiesburg, MS

Formation and Properties of Thermosetting and High Temperature Polymers—Prof. John K. Gillham, Polymer Materials Program, Dept. of Chemical Engineering, Princeton University, Princeton, NJ

Statistical Evaluation of Structure-Properties Relationships in Novel Automotive Clearcoat Concepts—Dr. Klaas J.H. Kruithof, Manager, Innovation R&D, and Dr. Henk J.W. van den Haak, Automotive Finishes Laboratory, Research Center Sassenheim, Coatings Div., AKZO Coatings Nederland bv, Sassenheim, The Netherlands

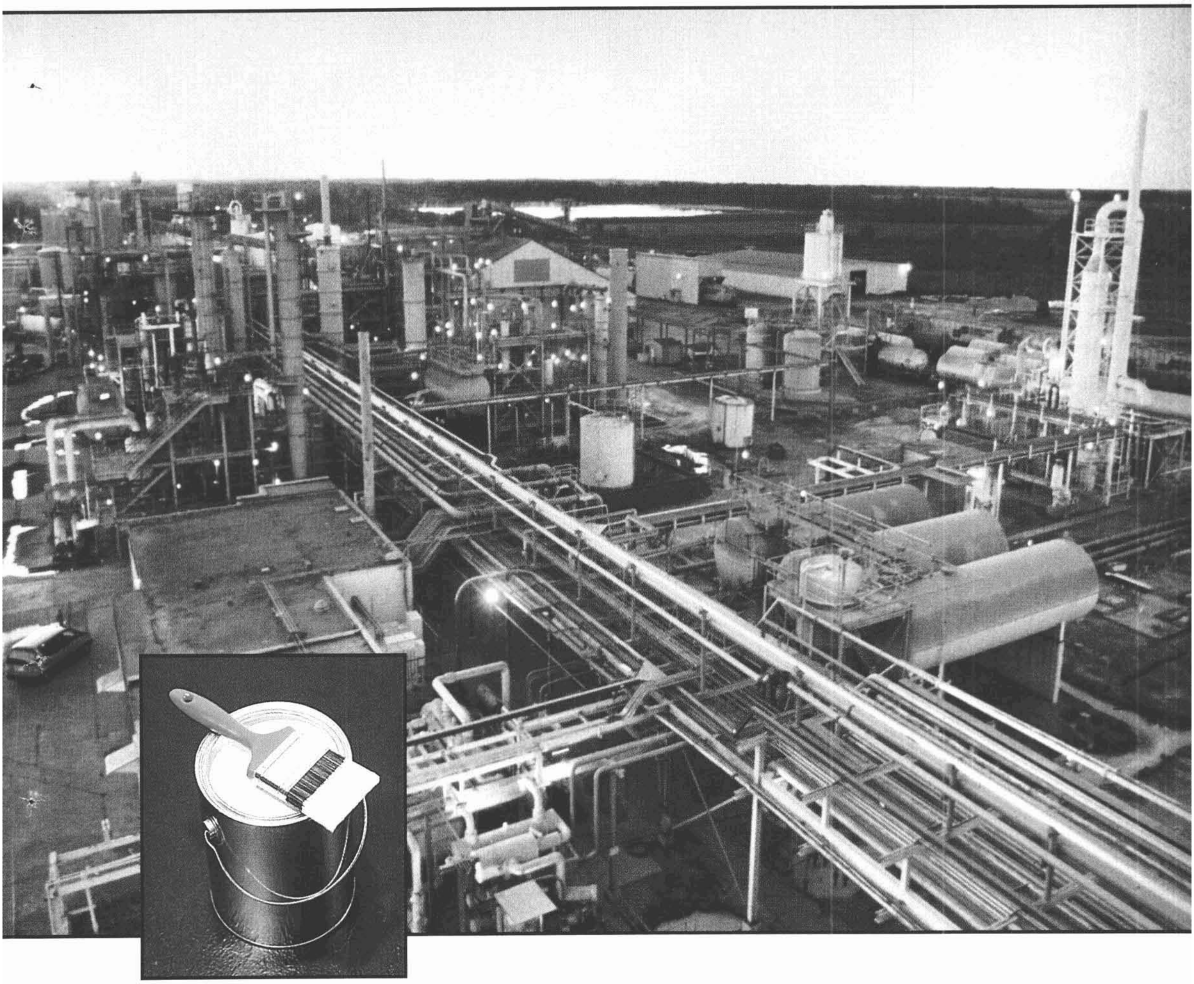
A New Class of Radical Scavengers for Coatings—Dr. M.S. Holt and Dr. Andrew Mar, Additives Div., CIBA-GEIGY Corp., Ardsley, NY

REGULATORY COMPLIANCE IN THE NINETIES
(2:00-4:30)
Grand Ballroom Suite A

Moderator—Adrian S. Adkins, Market Manager-Coatings, Schoofs Incorporated, Moraga, CA

Update on Proposition 65—Patrick M. Meehan, Division Counsel, The Clorox Co., Oakland, CA

High Technology and Environmental Protection—Dr. tekn. Paul Gatenholm, Scandinavian Paint and Printing Ink Research Institute, Horsholm, Denmark (Presented on behalf of Scandinavian Paint and Varnish Technologists)



The Regulatory Aspects of Coatings—Dean Simeroth, California Air Resources Board, Sacramento, CA

Health, Safety, and Legislation in the UK and Europe—Kenneth Smith, Manager of Health and Safety, Cray Valley Products Limited, South Wales, United Kingdom

California Survival Story: Paint Making in the Golden State—Los Angeles Society for Coatings Technology. Presented by Robert Sypowicz, Consultant, Diamond Bar, CA

GENERAL PAPERS IN COATINGS TECHNOLOGY-I
(2:00-4:30)
Grand Ballroom Suite B

Moderator—David W. Graham, General Manager, Templeton Div., Lilly Industrial Coatings, Inc., Templeton, MA

Development of New Additives to Improve Scratch Resistance and Impart Slip to Solvent-Based Coatings Systems—Ferdinand Fink, Wernfried Heilen, and Jay W. Adams, Tego Chemie Service USA, Hopewell, VA (A Roon Awards competition paper)

Performance Capabilities of Intermediate Film-Build Electrocoat vs High Film-Build Electrocoat—John A. Gilbert, Coatings and Colorants Div., BASF Corp., Southfield, MI

Electrodeposition Mechanism of Organic Coatings for Aluminum Containers—P.J. Palackdharry and J.A. Thyne, Packaging Products Div., The Dexter Corp., Waukegan, IL (A Roon Awards competition paper)

The Reaction of Hydroxylated Solvents with Isocyanate Resins—Roger A. Heckman, ARCO Chemical Co., Newtown Square, PA

Evaluation of the Atmosphere for Levels of HDI Monomer and the Polyisocyanate Resins Based on HDI—Dr. Michel Desbois, Research and Technical Manager-Polyisocyanates, Rhone-Poulenc, Decines, France

IMPROVED DURABILITY FOR THE NINETIES
(2:00-4:30)
Versailles Ballroom

Moderator—David A. Cocuzzi, Manager of Coil Coating Technology, Hanna Chemical Coatings Corp., A Subsidiary of Reliance Universal, Inc., Columbus, OH

Prediction of Durability of Coil Coatings—Shoichi Tanaka, Yasuhiko Haruta, Hideo Hikida, and Tadashi Matsudaira, Kansai Paint Co., Ltd., Kanagawa, Japan

Evaluation Method on Photodegradation of Paint Films by Using ESR Spectrometer—Kiyoshi Hikita and Shingo Okamoto, Nippon Oil and Fats Co., Ltd., Tokyo, and Hiroaki Ohya-Nishiguchi, Science Faculty, Kyoto University, Kyoto, Japan (Presented on behalf of Japan Society of Colour Material)

Crack Formation and Stress Development in an Organic Coating—Dr. Maarten Oosterbroek, Ruurd J. Lammers, and Leo G.J. van der Ven, AKZO Research Laboratories, Arnhem, The Netherlands, and Dan Y. Perera, Coatings Research Institute, Limelette, Belgium

Analytical Studies of Light Stabilizers in Two-Coat Automotive Finishes—Dr. H. Bohnke, L. Avar, and E. Hess, Sandoz Ltd., Basle, Switzerland

TiO_2's Contribution to the Durability and Degradation of Paint Film, II. Predication of Degradative Activity—Dr. Juergen H. Braun, Research Associate, Chemicals and Pigments Dept., E.I. du Pont de Nemours & Co., Inc., Wilmington, DE (A Roon Awards competition paper)

THURSDAY, NOVEMBER 9

RAW MATERIALS IN THE NINETIES
(9:00-11:00)
Grand Ballroom Suite A

Moderator—Richard M. Hille, Products Manager, General Paint and Chemical Co., Cary, IL

The Supply and Demand of Titanium Dioxide Worldwide—T. William Boaz, Industry Manager, White Pigments and Minerals Products Div., Chemicals & Pigments Dept., E.I. du Pont de Nemours & Co., Inc., Wilmington, DE

The Supply and Demand of Agricultural Feedstocks Worldwide—Bill Reutz, National Sales Manager, Oilseed Processing Div., Cargill, Inc., Minneapolis, MN

The Supply and Demand of Petrochemical Feedstocks Worldwide—Ian Harris, Market Manager, Trade Polymers, Rohm and Haas Co., Philadelphia, PA

Moderator and speakers will assemble as a panel for an open discussion period to conclude the session.

MANUFACTURING COMMITTEE SEMINAR ON MANUFACTURING FOR QUALITY AND PROFITABILITY IN THE NINETIES
(9:00-11:00)
Versailles Ballroom

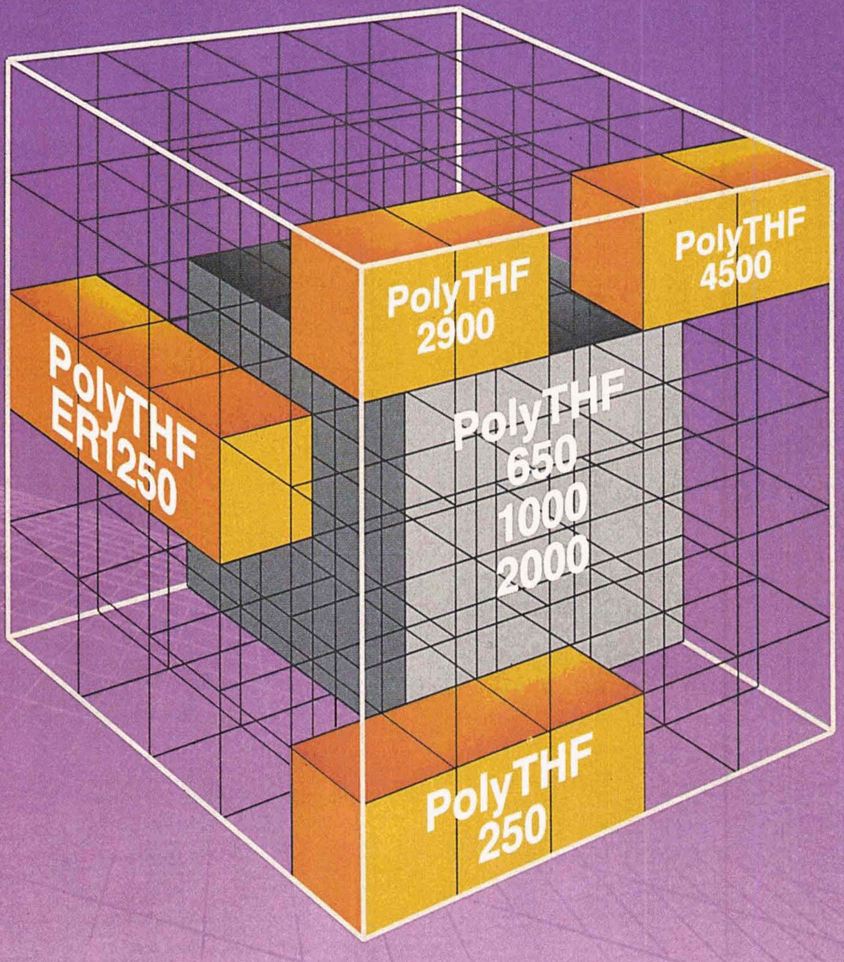
Moderator—Joseph P. Walton, Executive Vice President, Jamestown Paint & Varnish Co., Jamestown, PA

How Quality Can Improve Profitability—Jerry Hewitt, Philip Crosby & Associates, San Jose, CA

Integrating Safety and Quality to Improve Overall Business Results—T.C. Kuchler, Manager-Quality and Organizational Development, Chemicals and Pigments Dept., E.I. du Pont de Nemours & Co., Inc., Wilmington, DE

Total Quality Control—Why Most Programs Don't Get Optimum Results—Dr. Charles Rooney, President, Orr & Boss, Sarnia, Ontario, Canada

Poly THF® polytetramethylene ether glycol
More Innovations



Poly THF polyether diols with standard molecular weights of 650, 1000 or 2000 are widely used as the ideal soft segment for thermoplastic and crosslinked elastomers in applications where low temperature flexibility, hydrolytic stability, microbial resistance and high performance mechanical properties are required.

BASF invented acetylenic chemistry and continues to lead in its growth and development. Now, BASF has extended the range of available formulations to include—

Poly THF® 250
This low molecular weight diol is liquid at room temperature and is water soluble. It can be used effectively to achieve specific physical and performance properties in a variety of elastomeric applications.

Poly THF® 2900 and 4500
Two high molecular weight diols with narrow molecular weight distribution. They both provide exceptional properties in soft, flexible elastomers, and have demonstrated value when used in some adhesive applications.

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Is a random copolymer of Tetrahydrofuran and ethylene oxide with a molecular weight of 1250. Urethanes utilizing this product show improved hydrocarbon and solvent resistance while maintaining hydrolytic stability.

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Following speaker presentations, six members of the FSCT Manufacturing Committee will provide brief overviews of their experiences with impact of these topics on their operations:

Profitability—Don Mazzone, The O'Brien Corp., S. San Francisco, CA, and John Schluter, Monarch Paint Co., Houston, TX

Safety—Larry Kytasaari, Tnemec Co., Inc., Kansas City, MO, and John Covington, Covington Manufacturing Consultants, Millersville, MD

Optimizing Quality—Valerie Braund, General Paint Ltd., Vancouver, B.C., Canada, and Cleties Crowe, Crowe Industrial Coatings, Stone Mountain, GA

Moderator and speakers will assemble as a panel for an open discussion period to conclude the seminar.

Presentation of the 1989 Morehouse Golden Impeller Award for outstanding achievement in dispersion technology will be made at this session.

SOCIETY PAPERS
(9:00-Noon)
Napoleon Ballroom

Moderator—Patricia A. Shaw, Technical Director, Davlin Paint Co., Berkeley, CA

Effect of Coalescents on Paint Properties of Vinyl Acrylic Emulsion Based Flat Paints—Toronto Society for Coatings Technology. Presented by Emerlinda P. Cruz, Paint Chemist, Reichhold Limited, Weston, Ontario, Canada

Poly (Epoxy-Urethane-Acrylic) Interpenetrating Polymer Networks (IPNs) for Primer Applications. II—Detroit Society for Coatings Technology. Presented by Dr. Rose A. Ryntz, AKZO Coatings, Inc., Pontiac, MI

Performance Comparison of Exterior Finishes on Hardboard Siding—Kansas City Society for Coatings Technology. Presented by Steve Bussjaeger, Technical Director, Davis Paint Co., N. Kansas City, MO

Paint Spray Booth Filters: Hazardous Waste or Not?—Los Angeles Society for Coatings Technology. Presented by V.C. Jenkins, Ellis Paint Co., Los Angeles, CA

Changes in Hiding During Latex Film Formation—Cleveland Society for Coatings Technology. Presented by Freidun Anwari, Coatings Research Group, Inc., Cleveland, OH

PROGRESS IN POLYMER TECHNOLOGY-I
(9:00-11:30)
Grand Ballroom Suite B

Moderator—Dr. John L. Gardon, Vice President, Research and Development, AKZO Coatings, Ltd., Troy, MI

A Review and Update of Aliphatic Epoxy Resins—David Helfand, Group Leader, and Marcia Agostinho, Plastics Div., Research and Development Laboratories, CIBA-GEIGY Corp., Ardsley, NY

The Application of Time/Temperature Super Position Techniques to Powder Coating Cure—C.M. Neag, The Glidden Co., Strongsville, OH, and R.B. Prime, IBM Corp., San Jose, CA (A Roon Awards competition paper)

High Performance Epoxy Resins for Container Coatings Applications Based on In-Situ Advancement Technology—R.C. Whiteside, P.S. Sheih, and J.L. Massingill, Resin Products Dept., Dow Chemical U.S.A., Freeport, TX

The Glass Transition Temperature as an Index of Chemical Conversion for a High-T_g Epoxy/Amine System: Chemical and Diffusion Controlled Reaction Kinetics—Prof. John K. Gillham and G. Wisanrakkit, Polymer Materials Program, Dept. of Chemical Engineering, Princeton University, Princeton, NJ (A Roon Awards competition paper)

Solubilities Studies on IPN Modification of Acrylate and Methacrylate Systems—Dr. Pravin K. Kukkala, Dr. John C. Graham, and Shwu-Shya, Coatings Research Institute, Eastern Michigan University, Ypsilanti, MI (A Roon Awards competition paper)

USE OF COMPUTERS IN THE NINETIES
(2:00-4:30)
Grand Ballroom Suite A

Moderator—Mary G. Brodie, Corporate Director of Technical Facilities Planning and Development, The Sherwin-Williams Co., Cleveland, OH

Registration Hours

Tuesday, November 7 ....8:00 am-5:00 pm

Wednesday, November 8.................................8:00 am-5:30 pm

Thursday, November 9...................................8:00 am-5:30 pm

Friday, November 10.......................................8:00 am-3:00 pm

A Quality Management for the 1990's—Dr. Peter J. Hunt, President, Productivity Management Consultants, Clearwater, FL

Measurement and Analysis of Coatings' Properties—T.K. Rehfeldt, Measurement and Statistical Analyst, Computer Science Section, Automotive Technical Center, The Sherwin-Williams Co., Chicago, IL

The Color Computer Comes of Age—Dr. James T. DeGroff, Colortec Associates, Inc., Oldwick, NJ

Computerized Information Gathering: An Emerging Source of Professional Power—Ronald K. Helgeson, Vice President of Business Development, TELTECH Inc., Eden Prairie, MN

CORROSION COMMITTEE SYMPOSIUM ON NEW APPROACHES TO CORROSION CONTROL
(2:00-4:30)
Versailles Ballroom

Moderator—Donald W. Collier, Technical Director, Trade Sales Div., Porter Paint Co., Louisville, KY

Chemical Insight Into the Credibility of Accelerated Weathering Tests—Dr. John Gerlock, Polymer Science Dept., Ford Motor Co., Dearborn, MI

Development of a Self-Priming Topcoat Using Theoretical and Statistical Formulation Design—Charles R. Hegedus, Materials Engineer, Aerospace Materials Div., Naval Air Development Center, Warminster, PA

Cyclic Methods of Accelerated Corrosion Testing—Steve Lane, South Florida Test Service, Miami, FL, and Nigel D. Cremer, Managing Director, C&W Specialist Equipment, Shropshire, England

Electrochemical Impendance Spectroscopy for Solving Corrosion Control Problems with Protective Organic Coatings—Dr. Richard D. Granata, Senior Research Scientist and Associate Director, Corrosion Laboratory, Zettlemoyer Center for Surface Studies, Lehigh University, Bethlehem, PA

Presentation of 1989 Corrosion Committee Publication Award for best corrosion-related paper published in the JOURNAL OF COATINGS TECHNOLOGY will be made at this session.

PROGRESS IN POLYMER TECHNOLOGY-II
(2:00-4:30)
Grand Ballroom Suite B

Moderator—Dr. Darlene R. Brezinski, Director of Analytical and Computer Applications Research, DeSoto, Inc., Des Plaines, IL

Moisture Curing Silicone-Acrylic Resin—N. Shirai, M. Ooka, and H. Tanaka, Dainippon Ink & Chemicals, Inc., Tokyo, Japan

Polyester Resins Based Upon 2-methyl-1,3-propanediol: A New Commercial Glycol for the Nineties and Beyond—C.J. Sullivan, D.C. Dehm, E.E. Reich, and M.E. Dillon, ARCO Chemical Co., Newtown Square, PA

Two-Component Isopolyester Urethane Coatings for Plastics—Stephen H. Shoemaker, Research and Development Dept., Amoco Chemical Co., Naperville, IL

FDA-Compliant Polyester Coatings for Rigid Packaging—T.P. Pillai and P.J. Palackdharry, Packaging Products Div., The Dexter Corp., Waukegan, IL (A Roon Awards competition paper)

Room Temperature Crosslinking Urethane-Acrylic Composite Polymer Emulsions—Y. Hasegawa, S. Yoshioka, K. Ohnishi, and F. Yoshino, Dainippon Ink & Chemicals, Inc., Tokyo, Japan

FRIDAY, NOVEMBER 10

IN PURSUIT OF LOWER VOC
(9:00-10:30)
Napoleon Ballroom

Moderator—Sidney Lauren, Chairman, FSCT Educational Committee, Nashua, NH

Modifying Acrylic, Polyester, Epoxy, and Polyurethane Coatings with Caprolactone Polyols for Lower VOC—Daniel Goldberg and R.F. Eaton, UCAR Coatings Resins Dept., Union Carbide Corp., Bound Brook, NJ

A Second Generation Modifier for Low VOC Polyurethane and Melamine Coatings—Cheryl N. Blomquist, Commercial Development Manager, Richard S. Offin, Marketing Manager, and Clayton Crawford, Coatings Chemist, CasChem, Inc., Bayonne, NJ

Additives for High Solids/Low VOC Coatings—New York Society for Coatings Technology. Presented by Jeffrey C. Kaye, MacArthur Petroleum & Solvent Co., Newark, NJ

RECENT STUDIES IN PIGMENT EFFECTS
(9:00-10:30)
Elmwood Room

Moderator—Gary W. Gardner, Director of Research and Development, Tnemec Co., Inc., Kansas City, MO

"Designed Permeability" of Micaceous Iron Oxide Coatings—Dr. Malcolm C. Hendry, Consultant, Houston, TX

The Water Sensitivity of Cast Calcium Carbonate Filled Acrylic Acid Copolymer Films—Dr. Richard J. Ruch, Shunqiong Yue, Carl J. Knauss, and Charles A. Kumins, Dept. of Chemistry, Kent State University, Kent, OH

Factors Affecting Titanium Dioxide Dispersion in Trade Sales Paints—Alain Brisson and A. Haber, Technical Service Dept., Tioxide Canada Inc., Sorel, Quebec, Canada

GENERAL PAPERS IN COATINGS TECHNOLOGY-II
(9:00-10:30)
Grand Ballroom Suite B

Moderator—Dr. Percy E. Pierce, Manager of Physical and Color Research, PPG Industries, Inc., Allison Park, PA

Use of Image Analysis Technique to Quantify Pigment Dispersion—Montreal Society for Coatings Technology. Presented by Alain Brisson, Chemist, Technical Service Dept., Tioxide Canada Inc., Sorel, Quebec, Canada

Coupling Solvent Effects on Water-Reducible Alkyd Resins—Dr. Rhonda G. Vance, Nancy H. Morris, and Charles M. Olson, Chemicals and Metals Dept., The Dow Chemical Co., Midland, MI

A European Approach to UV Protection with a Novel Pigment—Robert F. Sharrock, Technical Manager, Coatings Industry, Hilton Davis Co., Cincinnati, OH

ANNUAL BUSINESS MEETING
(9:00-10:00)

Annual Business Meeting of the Federation

Presentation of these awards: A.F. Voss/*American Paint & Coatings Journal* . . . Southern Society A.L. Hendry . . . Outstanding Service . . . Society Speaker . . . Ernest T. Trigg

Installation of Officers, *1989-90*

MATTIELLO MEMORIAL LECTURE
(10:30-11:30)
Versailles Ballroom

Introductory comments by Dr. Loren Hill, Science Fellow, Surface Coatings Group, Monsanto Polymer Products Co., Springfield, MA, and Chairman of the Joseph J. Mattiello Lecture Committee

Learning to Leap: Rising to the Technical Challenge of Today's Coatings Industry—Dr. Marco Wismer, Consultant, Poway, CA, formerly Vice President, Science and Technology, PPG Industries, Inc.

AWARDS LUNCHEON*

Presentation of these awards: George Baugh Heckel . . . Paint Show . . . Roon Foundation

Featured Speaker: George Plimpton, Humorist, TV Personality, and Author

***Note**: Awards Luncheon will be in the Grand Ballroom of the *New Orleans Hilton Hotel*

Paint Show Hours

Wednesday, November 8	11:00 am-5:30 pm
Thursday, November 9	9:00 am-5:30 pm
Friday, November 10	9:00 am-3:00 pm

Here's how simple research and development can be.

What can you do when your product quality is threatened by federal regulations?

That's the issue makers of coatings for the auto industry face as government tightens rules for VOCs—Volatile Organic Components.

The dilemma: comply with new standards and sacrifice properties, or maintain properties and fall short of compliance.

There's really no easy way out; yet a phone call to Henry Heck, the Automotive Coatings Project Leader at Dow, resulted in a simple solution.

Henry assembled a Dow development team, gave them the run of the lab (more than a million dollars worth of equipment to work with) and told them to find an answer.

The result: A new hydroxy butyl acrylate monomer than helps coatings resins meet VOC requirements without sacrificing properties. (What's more, resins made from HBA resisted micro-cracking better. As Henry says, "Once you're into it, you might as well go all the way.")

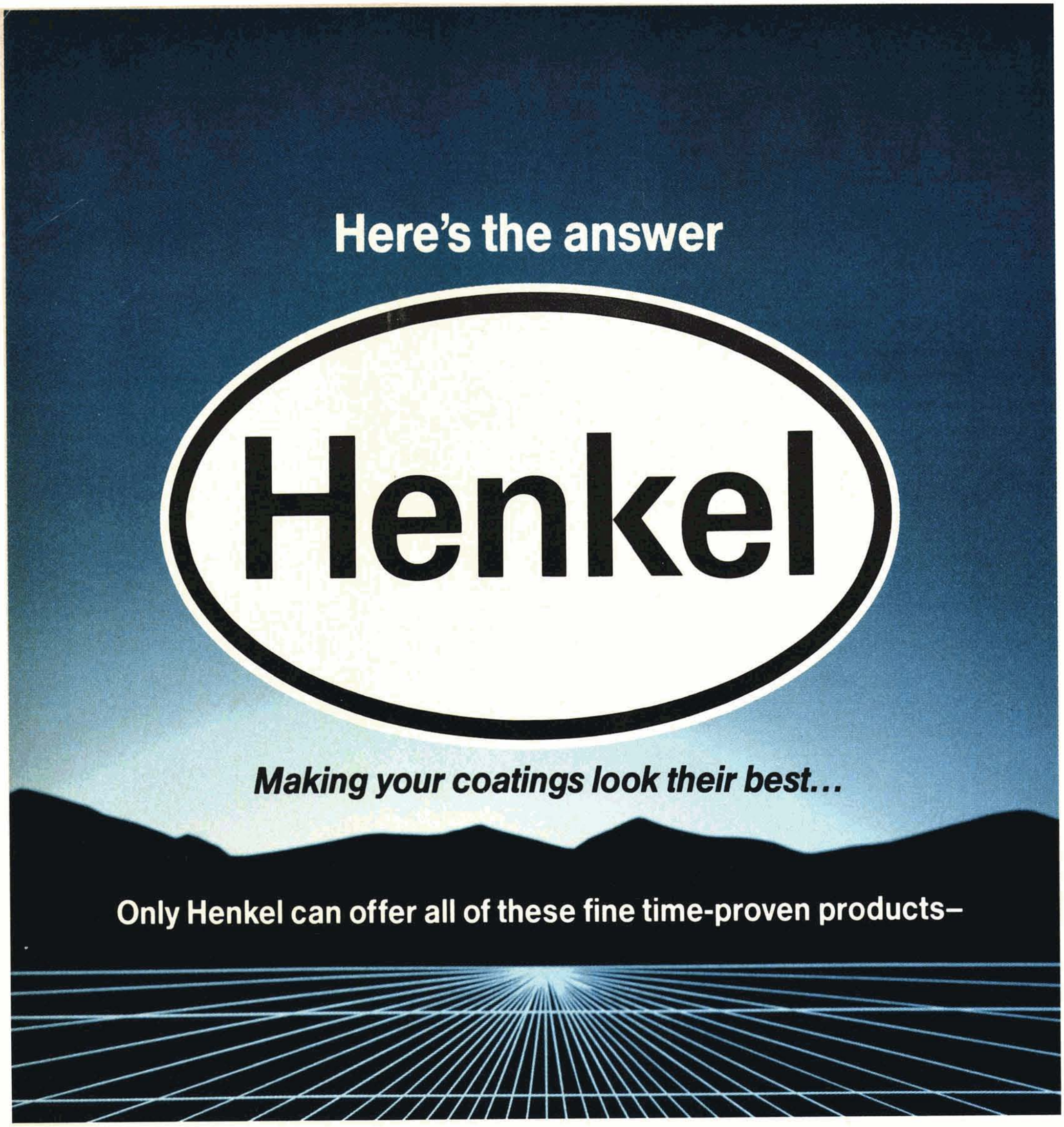
Soon, coatings manufacturers will have a new tool to make topcoats that not only look good to buyers, but look good to regulators.

"Critical mass," says Henry. "That's what helps our customers. Dow is like a giant tool box. If a customer has a problem, or needs a new monomer, the solution's already there, or we can make it."

Productive research and development is just part of the story. If you would like to know more about the Dow tool box, and how it can give you a business advantage, call 1-800-258-CHEM (2436), Coatings.

DOW*

*Trademark of The Dow Chemical Company.


Here's the answer
Henkel
Making your coatings look their best...
Only Henkel can offer all of these fine time-proven products–

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1989 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
THE NEW ORLEANS HILTON AND THE RIVERGATE
WEDNESDAY, THURSDAY, AND FRIDAY, NOVEMBER 8, 9, 10, 1989

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.

"COATINGS WORLDWIDE: MEETING THE NEEDS OF THE NINETIES"

The theme of the 1989 Annual Meeting underscores the coatings industry's heightened awareness that it is part of a global marketplace, and that all areas of interest and endeavor are being viewed from an increasingly international perspective. Programming will focus on such areas pertinent to the "Decade of the Nineties" as raw material availability, uses of computers, environmental regulations, new approaches for corrosion control, manufacturing for excellence, and advanced topics on the "cutting edge" of the industry.

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.

ANOTHER RECORD PAINT SHOW WILL FEATURE LATEST PRODUCTS/SERVICES OF MORE THAN 220 EXHIBITORS

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 220 exhibitors from the U.S., Canada, and Europe, will utilize almost 74,000 net square feet of exhibit space at the Show. Exhibit hours will be 11:00 - 5:30 on Wednesday; 9:00 - 5:30 on Thursday; and 9:00 - 3:00 on Friday.

The Paint Show will be held at both the New Orleans Hilton's Exhibition Hall and at the adjacent Rivergate Exhibition Center.

HOTELS/RESERVATIONS: MARRIOTT AND SHERATON CO-HEADQUARTERS

Nine hotels in New Orleans have reserved blocks of rooms for the Annual Meeting and Paint Show. The Marriott and Sheraton will be the co-headquarters hotels.

The other cooperating hotels are: Meridien, Monteleone, Omni Royal Orleans, Westin Canal Place, Doubletree, Holiday Inn Crowne Plaza, and the Hilton. The Monteleone and Omni Royal Orleans are located in the French Quarter.

Rooms are subject to an 11% occupancy tax plus a \$2.00 per room night city ordinance tax. All hotel reservations will be processed by the FSCT Housing Bureau. Phone reservations will not be accepted. You will receive an acknowledgment of your reservation from the Housing Bureau. This is not the hotel confirmation; that will be sent to you directly from the hotel to which you have been assigned.

Reservations for the Hilton will be accepted for arrival beginning Wednesday, November 8, only. Any reservations requesting the Hilton for arrival prior to November 8 will be assigned to another hotel.

Requests for accommodations at either the Marriott or Sheraton will be limited to ten rooms per company. A parlor counts as one room. All hotels require deposits. Please mail your deposit directly to the hotel. Additions, changes, and cancellations must be submitted in writing directly to the hotel in which you have been confirmed. (All hotels are in New Orleans, LA — zip codes in parens.)

Marriott
Canal & Chartres Sts. (70140)

Sheraton
500 Canal St. (70130)

Meridien
614 Canal St. (70130)

Monteleone
214 Rue Royale (70140)

Omni Royal Orleans
621 St. Louis St. (70140)

Westin Canal Place
100 Rue Iberville (70130)

Doubletree
300 Canal St. (70140)

Holiday Inn Crowne Plaza
333 Poydras St. (70130)

Hilton
Poydras at the Mississippi River (70140)

HOTEL ROOM AND SUITE RATES

Map				Suites	
No.	Hotel	Singles	Doubles/Twins	1 BR	2 BR
1	Marriott	$112	$128	$360-400	$488-528
2	Sheraton	115	130	183-310-480	310-705
	Towers	135	170	480-600	705
3	Meridien	95	105	275 & up	500 & up
4	Monteleone	92	104	215-425	325-550
5	Omni Royal Orleans	99,140,165	160,185	310,350	475,515
6	Westin Canal Place	115	130	350-425	525-600
7	Doubletree	85	95	160-200	300-400
8	Holiday Inn Crowne Plaza	95	110	226-446	349-592
9*	New Orleans Hilton	115	135	290-950	375-1125
	Towers	165	185	575-950	725-1100

Note: Rates subject to 11% occupancy tax plus a $2.00 per room night city ordinance tax.
All hotels require a first-night room deposit. Please send directly to hotel.
*Reservations at the Hilton will be accepted for arrival beginning Wednesday, November 8, only.

(1) Marriott
Canal & Chartres Sts. (70140)

(2) Sheraton
500 Canal St. (70130)

(3) Meridien
614 Canal St. (70130)

(4) Monteleone
214 Rue Royale (70140)

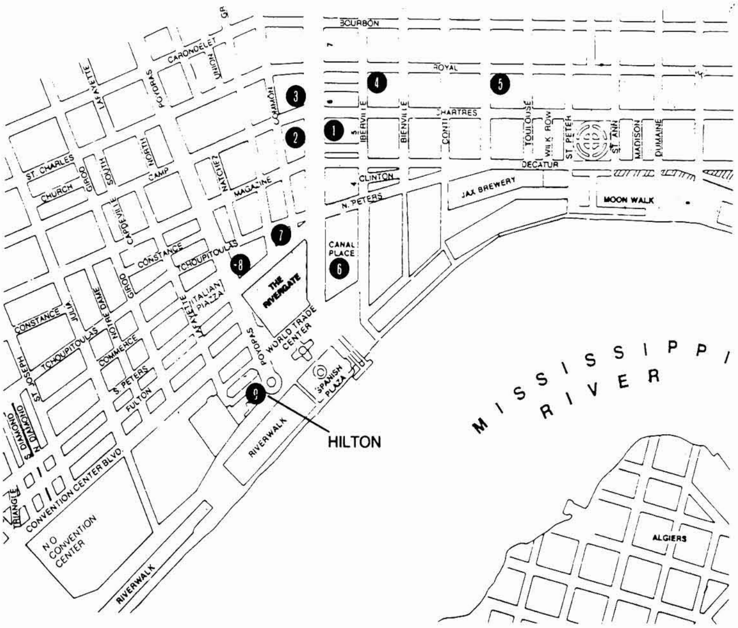
(5) Omni Royal Orleans
621 St. Louis St. (70140)

(6) Westin Canal Place
100 Rue Iberville (70130)

(7) Doubletree
300 Canal St. (70140)

(8) Holiday Inn Crowne Plaza
333 Poydras St. (70130)

(9) New Orleans Hilton
Poydras at the Mississippi
River (70140)



1989 FSCT ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
NEW ORLEANS HILTON AND RIVERGATE, NEW ORLEANS, LA
WEDNESDAY, THURSDAY, AND FRIDAY, NOVEMBER 8, 9, 10

67th Annual Meeting & 54th Paint Industries Show
FSCT 1989

APPLICATION FOR HOTEL ACCOMMODATIONS

Mail to: FSCT Housing Bureau
1520 Sugar Bowl Dr.
By 10/5/89 New Orleans, LA 70112

Please indicate below the type of accommodations desired and the choice of hotels. (Refer to the 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 the prevailing availability. You will receive an acknowledgment of your reservation from the Housing Bureau. This is not the hotel confirmation. That will come to you directly from the hotel to which you have been assigned. Changes/additions/cancellations must be submitted in writing to the hotel.

TYPE OF ACCOMMODATION	NUMBER	RATE REQUESTED
Single (1 person)		
Double (2 persons)		
Twin (2 persons)		
Suite (parlor and 1 bedroom)		
Suite (parlor and 2 bedrooms)		

CHOICE OF HOTELS	
1ST	
2ND	
3RD	
4TH	

NAMES OF ROOM OCCUPANTS AND DATES OF ARRIVAL/DEPARTURE

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

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

SEND CONFIRMATION FOR ALL RESERVATIONS TO:

Name ______________________ Telephone ______________

Company ______________________ FAX ______________

Address ______________________

City, State, Zip ______________________

Country ______________________

Name of Credit Card ______________ Signature ______________

Credit Card Number ______________ Exp. Date ______________

Note: (1) Requests for accommodations at either the Marriott or the Sheraton will be limited to 10 rooms per company.
(2) Reservations for the Hilton will be accepted for arrival beginning Wednesday, November 8, only.

SPECIAL FARES AVAILABLE FROM DELTA AIR LINES

Delta Air Lines, in cooperation with the FSCT, is offering a special discount fare which affords passengers a 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. The discount from Canada is 35%.

To take advantage of this discount, you must: (1) Travel between November 4-14, 1989; (2) Purchase tickets at least seven days in advance; (3) Phone 1-800-241-6760 for reservations. Immediately reference the FSCT file number: U0235. The special fares are available only through this number.

Discounts are good for both direct and connecting flights to New Orleans. If you use a travel agent, have your reservations placed through the toll-free number to obtain the same fare advantages. Delta has 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.

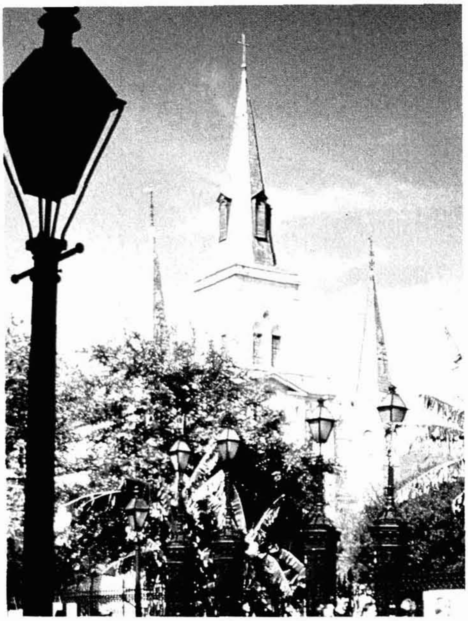
FEDERATION BOARD OF DIRECTORS TO MEET ON TUESDAY AT MARRIOTT

The Board of Directors of the Federation will meet on Tuesday, November 7, at 9:00 a.m. in the Marriott.

HILTON EXHIBITS – SITE OF DELTA FIRST-CLASS TICKETS DRAWING

The Federation will offer a special door prize during the Paint Show: a pair of Delta Air Lines first-class, round-trip tickets for any destination in the continental United States. Entries must be made at a special location at the Hilton Exhibition Hall. The drawing will be held at the Hilton Exhibition Hall at 11:00 a.m., Friday, November 10. Winner need not be present, however, the announcement of the winning entry will be made at the Federation's Annual Luncheon.

Hilton Riverside and Towers Hotel



St. Louis Cathedral, Jackson Square

FEDERATION ANNUAL LUNCHEON WILL BE HELD ON FRIDAY

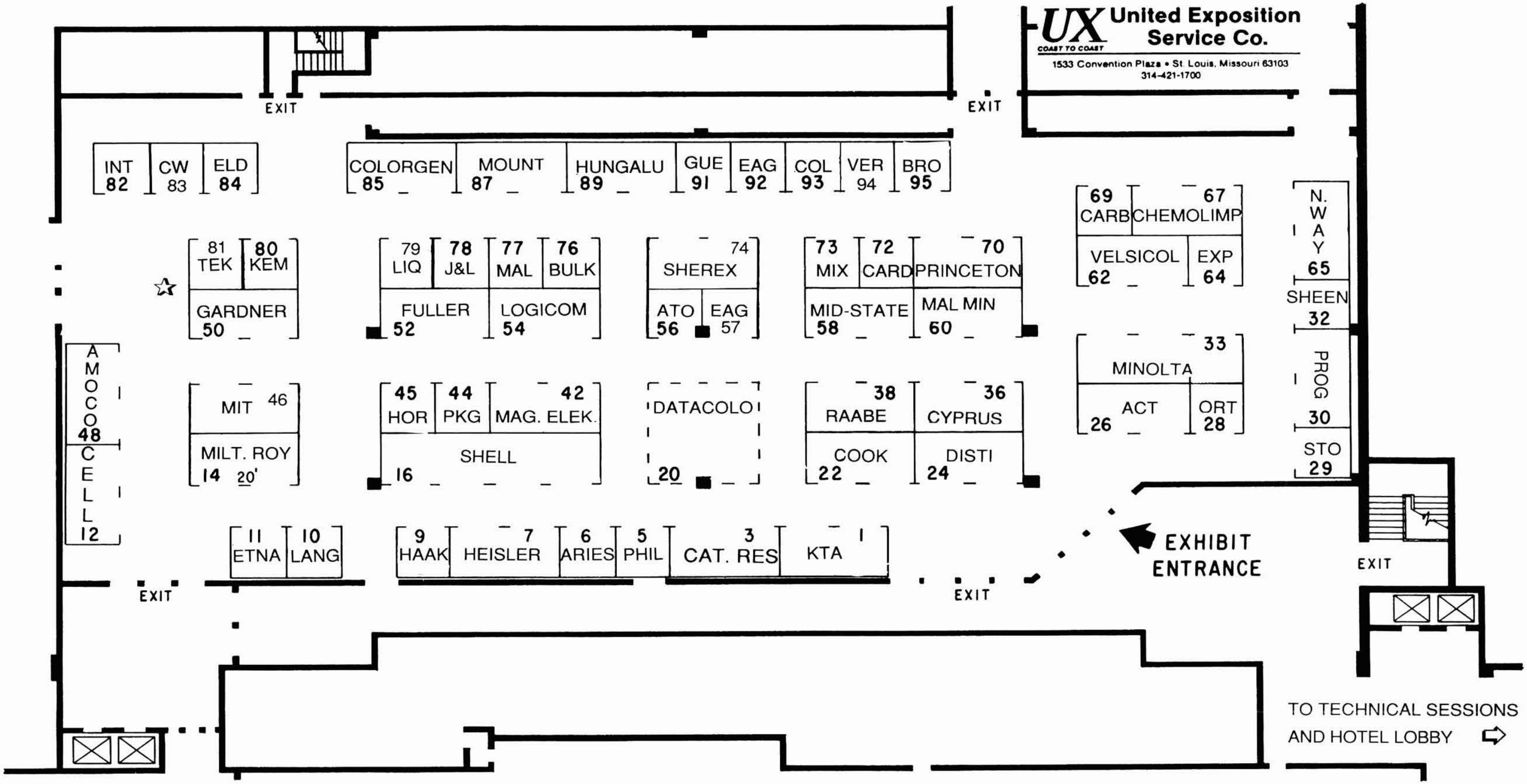
The annual Federation Luncheon will be held on Friday, November 10, at the New Orleans Hilton.

SPOUSES PROGRAM INCLUDES TOUR OF FRENCH QUARTER

The Spouses Program will open on Wednesday with a get-acquainted wine and cheese social in the Mardi Gras Ballroom of the Marriott Hotel. On Thursday, there will be a deluxe motor coach tour of the city, featuring the French Quarter, the elegant Garden District, the shores of Lake Pontchartrain, the unique St. Louis III Cemetery, and a visit to Germaine Wells' Mardi Gras Museum. Lunch will be served during the tour at the famous Arnaud's Restaurant in the French Quarter. Also included in the spouses' registration is Continental Breakfast served at the Marriott on Thursday and Friday mornings.

NPCA TO MEET SAME WEEK AT NEW ORLEANS HILTON

The National Paint and Coatings Association will hold its annual meeting on November 6-8, 1989, at the New Orleans Hilton Riverside and Towers. Persons wearing NPCA badges (who sign up at a special registration desk at the Hilton) will be admitted to the Paint Show on Wednesday only, with the compliments of the Federation.



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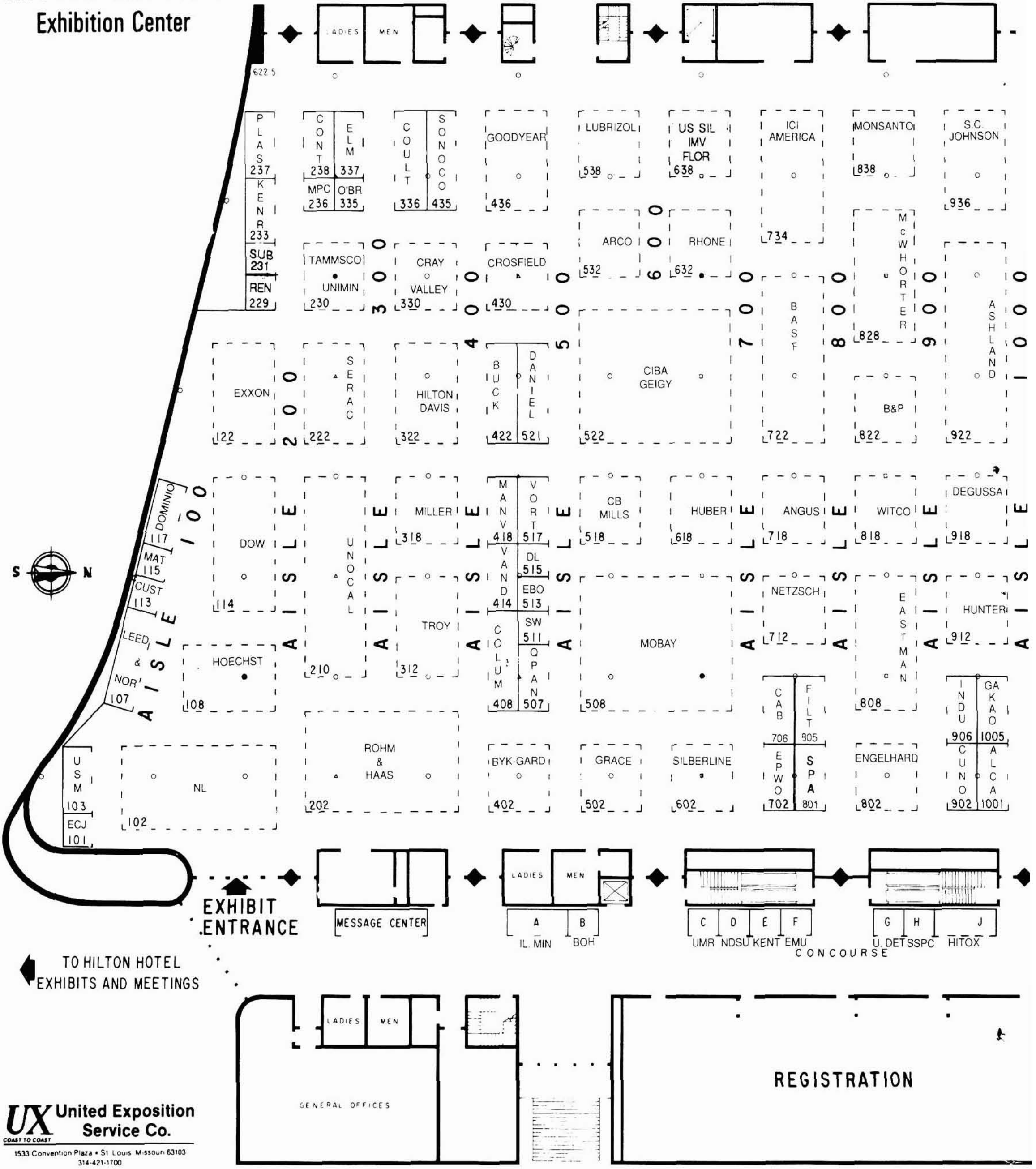

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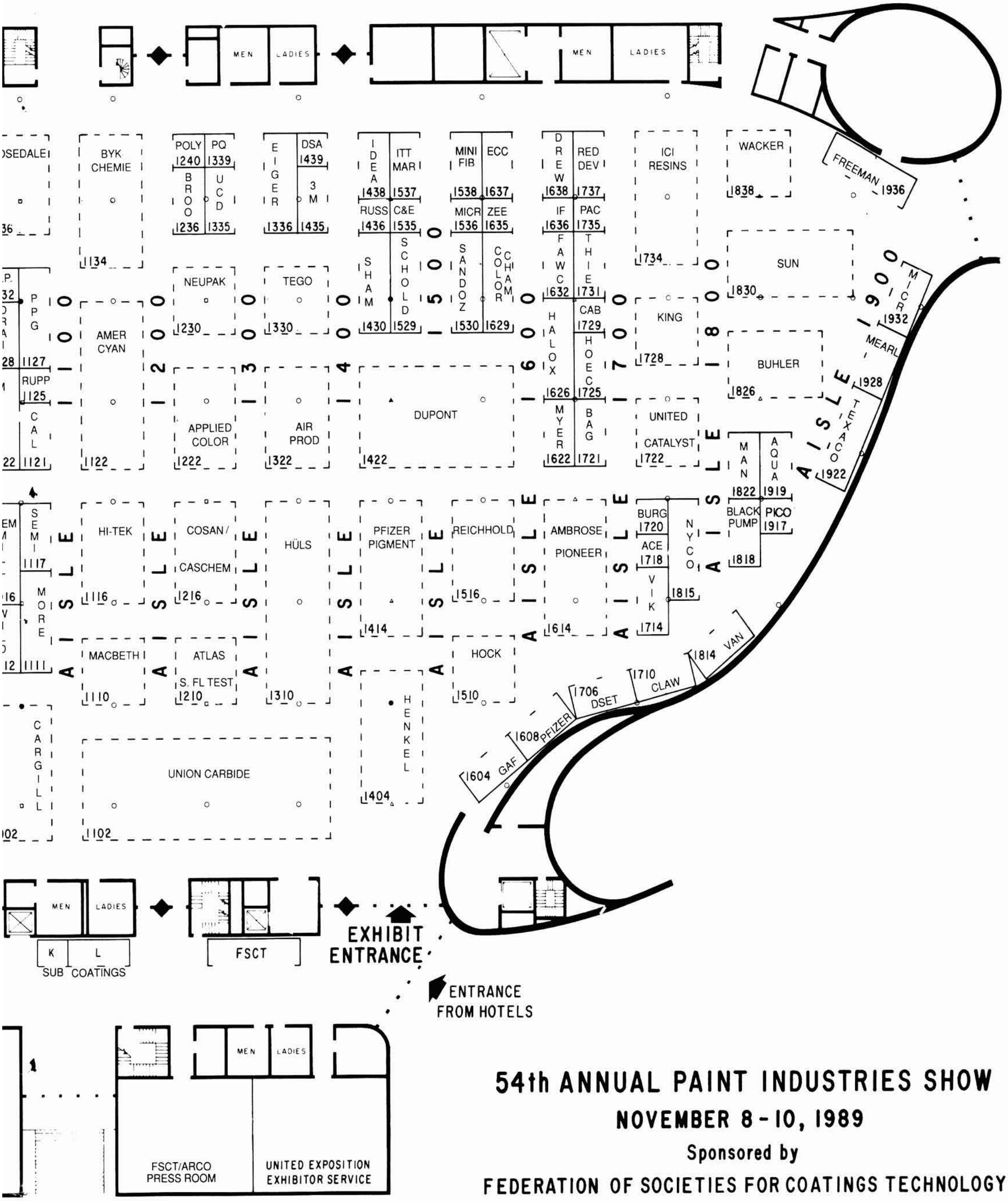

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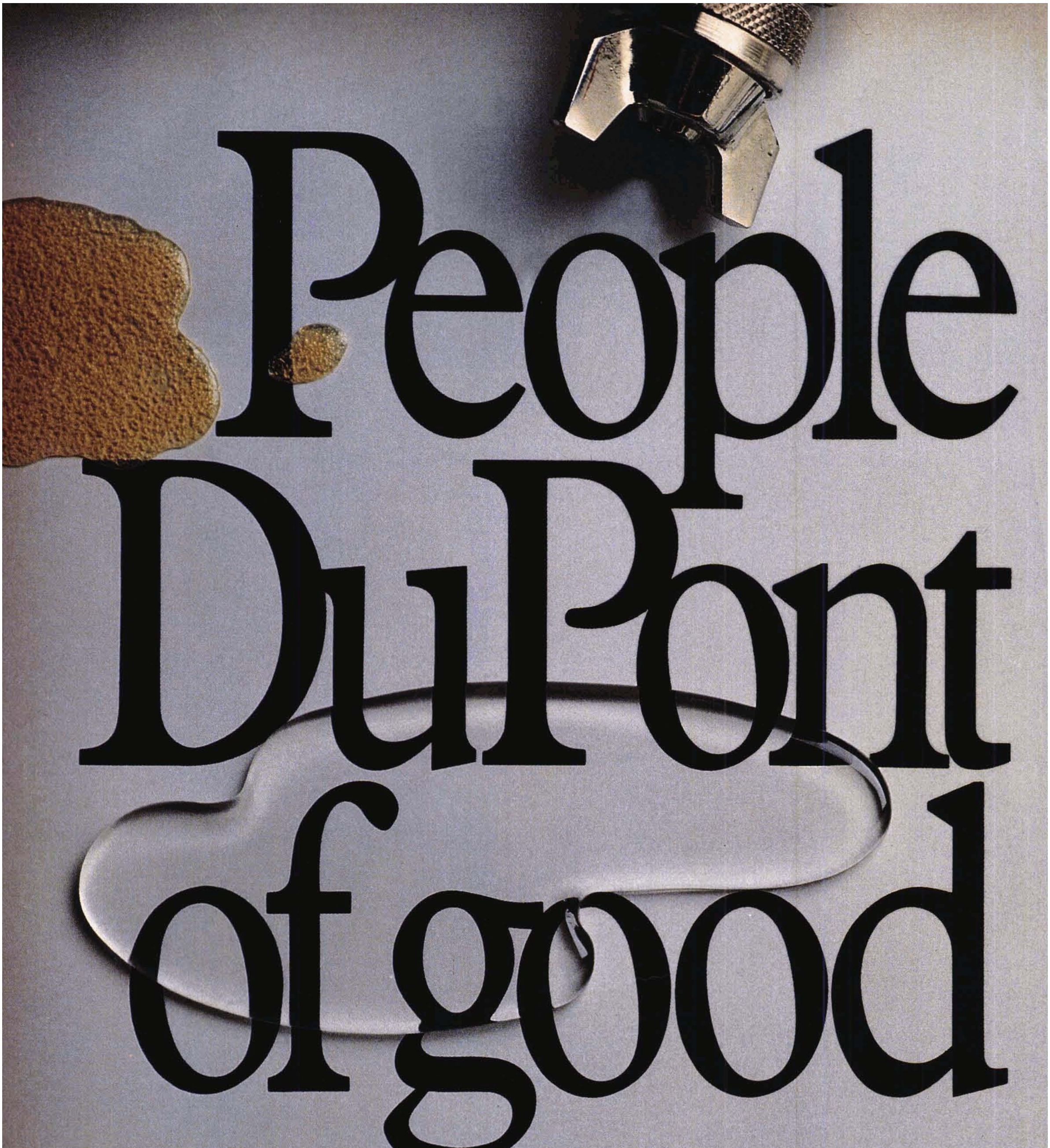
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Advanced Coatings Technologies	26
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Alcan-Toyo America, Inc.	1001
Ambrose Co./Pioneer Packaging	1614
American Cyanamid Co.	1122
Amoco Chemical Co.	48
Angus Chemical Co.	718
Applied Color Systems, Inc.	1222
Aqualon Co.	1919
Arco Chemical Co.	532
Aries Software	6
Ashland Chemical Co., IC&S Div.	922
Atlas Electric Devices Co./South Florida Test Serv.	1210
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B & P Environmental Resources	822
B.A.G. Corp.	1721
BASF Corp, Chemicals Div.	722
Blackmer Pump/Dover Resources Co.	1818
Bohlin Reologi, Inc.	B
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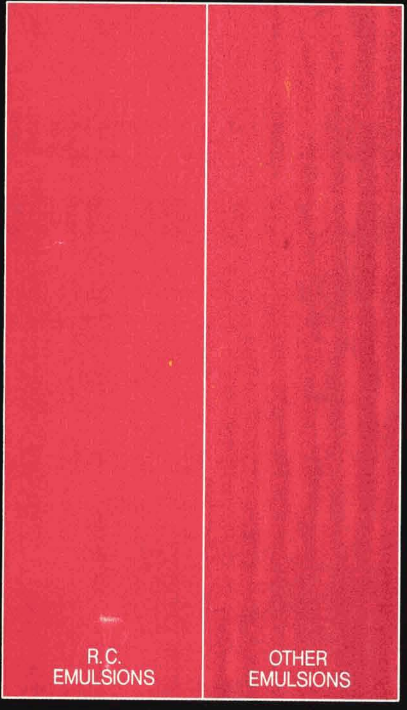

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Origin of Organoclay Rheological Properties in Coating Systems

Steven J. Kemnetz, Arlene L. Still, and Charles A. Cody
NL Chemicals, Inc.*
and
Rolf Schwindt
Kronos Titan-GmbH†

Work was conducted to study the rheological properties of organoclays in various coating systems. Experiments were designed to monitor the degree of dispersion, to define the role of polar activation, and to examine the conditions under which degelation of organoclays might occur. Several conclusions regarding the behavior of dispersed organoclays in coating systems can be drawn from this study: (1) dispersion and gelation are two separate and independent phenomena, (2) a gel promotor, such as water, is required to form a hydrogen bond network between clay platelets, (3) polar activators simultaneously act as dispersants and degellants, and (4) the organoclays operating on the new self-dispersing organoclay technology display a relatively high rate of dispersion without the need for a polar activator.

INTRODUCTION

Organoclays are widely employed as rheological control agents for organic systems; some typical examples of such systems are paints, cosmetics, greases, and inks. The combination of a chemical polar activator and mechanical shear (or work) is commonly utilized to disperse the organoclay additive. This combination allows the additive to develop and impart its full rheological potential to the system of interest. Once dispersed, rheological control can occasionally be lost via ''degellants,'' e.g., sulfonates, naphthenates, phosphonates, and chemicals which lead to a nonreversible breakdown in viscosity.

The basic causes of organoclay dispersion, viscosity build-up, and the potential for degelation of grease systems have been previously studied.[1-3] These studies found that chemical polar activators were necessary in grease systems to cause dispersion of the organoclays. Once dispersed, however, the polar activators interfered with the hydrogen bonding network set-up by the clay platelets and lessened the overall strength of the final gel network. The mechanism of dispersion was found to be a chemical interaction between the polar activator and the clay platelet of the organoclays such that the activator, upon attaching itself to the face of platelet, forced up the quaternary organic chains of the organoclay from this same surface, and caused an increase in basal d_{001}-spacing of the organoclay stacks. A schematic representation of this mechanism is presented in the sequence of *Figures* 1a–1d.

The presence of molecular water was found to be an absolute necessity in order to set up the gel network in a grease system.[3] The water molecules acted as intermolecular hydrogen bond bridges between clay platelet hydroxyls. A possible cause of degelation was suggested, i.e., ''degellant'' interfered with or more likely withdrew water from the hydroxyl network of the platelets (*Figures* 2a–2b).

Because of their widespread usage in many coating systems, it was deemed important to see if the organoclay behavior previously described for grease systems would also apply to paints and coatings. To carry out such a study, a ''simplified'' coating system of either organoclay/solvent or organoclay/solvent/resin was employed. The simplified systems are attractive from a scientific point of view since simplified systems should accurately display the rheological properties of a paint or coating,

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Presented at the XIXth FATIPEC Congress, in Aachen, Germany, Sept. 18-24, 1988.
*P.O. Box 700, Hightstown, NJ 08520.
†Leverkusen, West Germany.

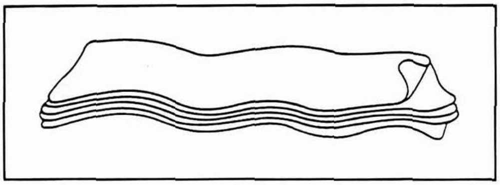


Figure 1a—A stack of organoclay platelets. The organic chains of the quaternary ions are not visible at this magnification

yet these systems are easier to deal with, both during formation and when under investigation.

EXPERIMENTAL

There are a wide variety of organoclay/resin/polar activator systems commercially available to the paint and coatings industry. The selections shown in *Table* 1 reflect some commercially available organoclays whereas the selections shown in *Table* 2 reflect an attempt on our part to examine a wide breadth of commercial combinations of organoclays, resins, and solvents while maintaining the concept of simplified versions. The systems investigated (*Table* 2) were without additional additives, such as pigments, driers, antiskinning agents, etc.

The organoclays listed in *Table* 1 were dispersed into the respective resin or solvent by hand stirring or by using either a Cowles Premier dispersator, a Kent Machine Works Inc. three-roller mill, or a Sonic Materials Inc. acoustic frequency probe, Model VC250. The Cowles unit was employed as a low speed (0-2000 rpm) conventional propeller mixer, maximum tipspeed of blade was 2.7m/sec (1¾ in. blade, 0-2000 rpm). The three-roller mill consists of three highly polished parallel metal cylinders in close proximity to each other rotating at low speeds. The direction of rotation of each cylinder is opposite to that of its neighbor. The sonic probe consists of a 250 watt output controller with a ½ in. diameter titanium metal horn. The Dispermat is a laboratory high speed impeller mixer with a continuously adjustable speed range from 0-20,000 rpm, equipped with a 4 cm vaned disc.

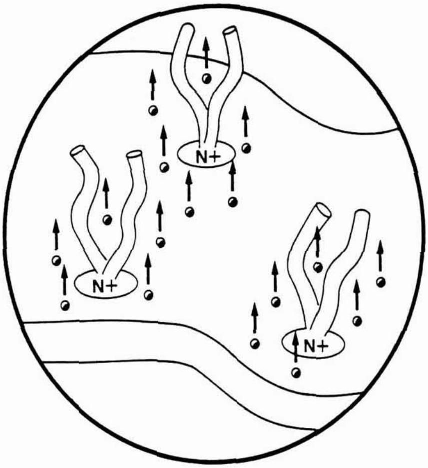


Figure 1c—Schematic representation of the chemical attachment of polar activator to the clay surface, the attachment forces the organic chains off of the surface of the platelet.
⬭ Nitrogen N+; ● Polar activator

Viscosities were measured with an LVT Brookfield Digital Viscometer or a Viscolab LC 10. Various spindles and rpms were employed; these variables are described in

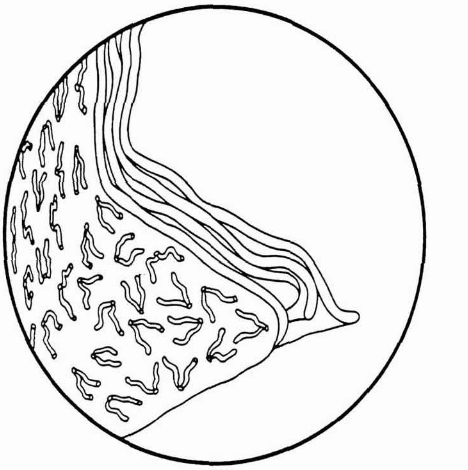


Figure 1b—A corner of the organoclay platelet stack seen in *Figure* 1a. The irregular forms lying on the surface of the top platelet represent the organic chains associated with 2M2HT quaternary ammonium ion

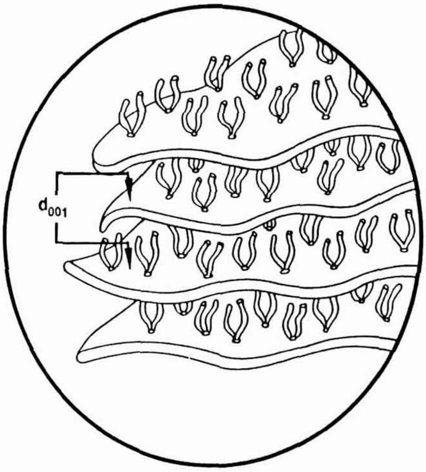


Figure 1d—Full expansion of the interplatelet distances by polar activation. The organic chains are completely displaced from the platelet surface. Note that the d_{001} spacing is the distance from top platelet surface to top platelet surface in an adjacent platelet

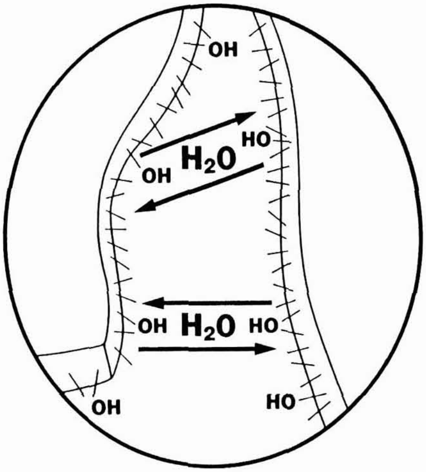


Figure 2a—The association between H_2O and edge hydroxyls (OH's) forms hydrogen bonds. The presence of these bonds leads to a gel network displaying thixotropic behavior

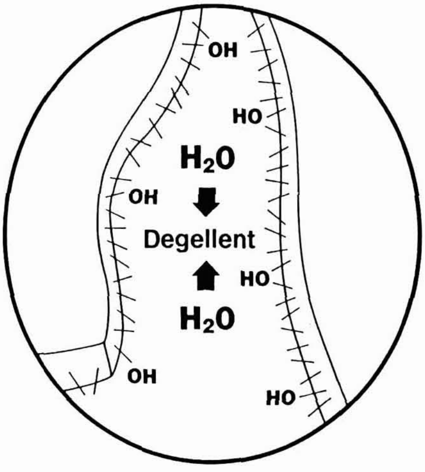


Figure 2b—Chemical degellants form a stronger association with H_2O than H_2O forms with the edge hydroxyls, thereby causing a loss in gel network structure

the text and tables where appropriate. A description of the Brookfield Digital Viscometer can be found elsewhere,[4] the LC 10 Viscolab is a rotating viscometer operating according to the Searle principle. The torque that results from the flow resistance of the substance to be measured acts on the measuring spindle and is measured electrically. The measuring equipment consists of the drive, the spindle quick-change coupling, as well as a liquid-filled thermostating chamber to take up the measuring system. A separate housing contains electronic system for revolution control, the torque measuring equipment, and the digital display for torque and temperature. Viscosity measurement is controlled through a computer system. The computer also serves to store and evaluate the measured data. Peripheral equipment consists of a printer and an X-Y plotter.

Previous investigations of grease systems had established a definite relationship between the infrared band width of the major clay absorption frequency and the degree of organoclay dispersion.[1-3] Similar studies were undertaken here for the solvents described in *Table* 2, using a Perkin-Elmer Model 621 infrared spectrometer or a Nicolet Model 7199 Fourier transform infrared spectrometer. To eliminate any interference from solvent peaks, the organoclay/solvent mix was placed in mineral oil, heated for 1 hr at 150°C to remove solvent, and then a transmission spectrum recorded after setting the strongest clay peak to .15% T, i.e., ~1 absorbance unit. The strongest absorptions occur at ~1040 cm^{-1} for bentonite based organoclays and ~1005 cm^{-1} for hectorite based organoclays. A numerical value for the band width was measured by recording the ½ width at ½ the maximum intensity (see *Figure* 3); the ½ band width being employed to eliminate any contribution from other silicate absorptions which appear in close spectral proximity. The ½ band width at ½ maximum peak intensity was recorded as the measure of dispersion.

INSTRUMENTATION

The X-ray diffraction analysis was performed with a Philips APD 3600 automatic powder diffraction system. The standard theta shaft of a vertical goniometer was replaced with one containing a sample spinner. A fixed slit system was used for this analysis, consisting of a ¼ degree divergence slit and a one degree receiving slit. The X-ray generator is a Philips XRG 3000 model which powers a long fine focus copper target diffraction tube. The detection system consists of an AMR graphite crystal monochromator with a scintillation counter and associated NIMS electronics. Additional accessories include a model 4010-1 graphics display terminal and a model 4031 hard copy unit, both by Tektronix. The system is controlled by a Data General Nova 4S computer.

Special sample holders for examining viscous liquids were designed and fabricated. The special sample holders

Table 1—Description of Some Commercial Organoclays And Notations

Organoclay	Text Notation
Dimethyl dihydrogenated beef tallow ammonium quaternary ion reacted with bentonite clay	2M2HT bentonite
Dimethyl dihydrogenated beef tallow ammonium quaternary ion reacted with hectorite clay	2M2HT hectorite
Benzyl dimethyl hydrogenated beef tallow ammonium quaternary ion reacted with hectorite clay	B2MHT hectorite
Surfactant modified benzyl methyl dihydrogenated beef tallow ammonium quaternary ion reacted with bentonite clay	Self-dispersing bentonite A (for aliphatic systems)
Stearate modified benzyl dimethyl hydrogenated beef tallow ammonium quaternary ion reacted with bentonite clay	Self-dispersing bentonite B (for polar systems)

Table 2—Organoclays, Resins, and Solvents Employed in this Study

Organoclay	Resin	Solvent
2M2HT bentonite	Long oil alkyd	Mineral spirits xylene
B2MHT hectorite	—	Methyl isobutyl ketone
Self-dispersing bentonite B	—	Methyl isobutyl ketone
2M2HT hectorite	Short oil alkyd	—
Self-dispersing bentonite A	Long oil alkyd	Mineral spirits

were fabricated from brass tubing (~½ mm wall thickness) which consisted of an inner and outer sleeve. An aluminum base and adjustable piston arrangement was designed to fit inside the inner brass sleeve. The fluid sample of organoclay/resin or organoclay/solvent was poured into the partially assembled holder to fill the cavity between the top of the piston and the top of the inner brass sleeve. A 0.15 mil Mylar film was carefully placed over each sample and drawn taut by sliding the outer brass sleeve over the Mylar. A flat sample to Mylar surface was achieved by moving the piston up or down by means of an adjusting screw through the base of the completely assembled holder until there was no distortion in the reflection of an overhead light fixture on the Mylar film. The loaded holder was transferred to the sample spinner, referenced to the focusing circle with a flat glass slide and locked into place with a set screw.

The samples were scanned while spinning from 1.4 to 12 degrees (2Θ) in 0.02 degree increments for three seconds per increment. The basal d_{001} spacing between clay platelets (*Figure* 1) was calculated via the Bragg diffraction relationship

$$d = \frac{n\lambda}{2 \sin \Theta}$$

where $n = 1$, λ = exiting wavelength and Θ is the angle of diffraction.

Infrared Technique to Monitor Organoclay Dispersion

The relative degree of organoclay dispersion in a coating system can be monitored via the infrared vibrational coupling between silicate molecules in adjacent platelets. For example, one of the Si-O-Si stretching motions in bentonite based organoclays absorbs at ~1040 cm^{-1} in the infrared spectrum. This Si-O-Si motion in one organoclay platelet can interact via a resonance mechanism with a similar Si-O-Si motion in an adjacent platelet, i.e., couple, leading to a broad band of coupled frequencies and thus a dramatic increase in the 1040 cm^{-1} band width. Conversely, as the distance between molecules in adjacent platelets increases because of dispersion, the Si-O-Si coupling diminishes and the previously broad Si-O-Si band dramatically narrows. Thus, the experimenter can measure the band width at ½ peak height (or, as in this study, the ½ band width) and predict the relative degree of dispersion. To demonstrate monitoring the degree of dispersion, a 2M2HT hectorite was hand stirred into xylene, and a clay band ½ width of 42 cm^{-1} recorded. When the same sample was subjected to sufficient shear to cause a high level of dispersion (a Cowles dispersator producing 2.7 m/sec velocity), the ½ band width at ½ peak height collapsed to 22 cm^{-1}. The 2M2HT bentonite and self-dispersible bentonite A rheological additives were also observed to follow the same pattern (see *Table* 3, for instance).

Another technique to determine organoclay dispersion would be to measure the actual distance between the organoclay platelets. It is possible to record the basal d_{001}-spacing of organoclay platelets after their incorporation into a coating or solvent/resin system via X-ray diffraction. The measurement of the basal d_{001}-spacing for various organoclay fluid systems subjected to various levels of shear on comparison to a dry powder control of the organoclay itself will elucidate the extent and mechanism of dispersion. To illustrate this, consider organoclays dispersed in their respective resin system (*Table* 2) by Cowles dispersator, then three-roller milling the mixture without polar activator, and three-roller milling the mixture with polar activator (a 95/5 mix of $MeOH/H_2O$ at 30% weight of organoclay). To generate controls, organoclays were hand stirred with and without polar activator in these same solvents. See *Table* 4 for the resulting basal d_{001} spacing measurements.

The data in *Table* 4 reveal that the basal d_{001}-spacing of the 2M2HT bentonite samples prepared in a long oil alkyd resin was expanded by high shear and without the use of polar activator. 2M2HT hectorite dispersed in a short oil alkyd resin and self-dispersing bentonite A dispersed in long oil alkyd resin displayed similar results. These data indicate that some chemical component of the resin system acts to expand the d_{001}-spacing of the organoclays, and that there is no need for external activation with agents such as $MeOH/H_2O$, as long as sufficiently high levels of shear of incorporation are present.

The basis for concluding the resin is responsible for swelling these organoclays is that the solvent fraction of

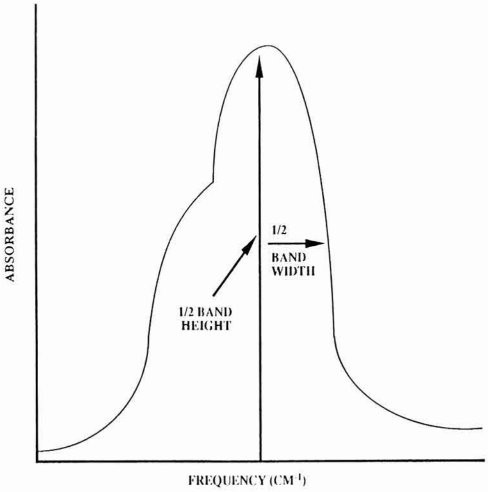


Figure 3—Infrared clay band width measurement of the Si-O-Si stretching region

Table 3—½ Infrared Band Widths at ½ Peak Height as a Function of Degree of Shear

Organoclay	Incorporation Method	Fluid System	½ Band Width at ½ Peak Intensity
2M2Ht bentonite	Hand stirred	Mineral spirits	$77 cm^{-1}$, $78 cm^{-1a}$
2M2Ht bentonite	Cowles dispersator @ 2.7 m/sec	Mineral spirits	$41 cm^{-1}$, $41 cm^{-1a}$
Self-dispersing bentonite A	Hand stirred	Mineral spirits	$63 cm^{-1}$
Self-dispersing bentonite A	Cowles dispersator @ 2.7 m/sec	Mineral spirits	$34 cm^{-1}$

(a) Duplicate measurement of the IR spectrum to check the precision of the data. Accuracy was within plus or minus one wavenumber (cm^{-1}).

the resin system was not responsible for expanding the d_{001}-spacing. This can be seen by examining the results for the 2M2HT bentonite sample that was hand stirred in mineral spirits. Here a portion of the sample was split in half, with one-half of the charge having no polar activator and the other half having MeOH/H_2O 30% weight incorporated as the polar activator. The basal d_{001}-spacing of both samples remained collapsed at 25Å. Thus, taken in entirety, these results imply that the only conclusion that can be drawn in this model system is that a certain level of shear and the presence of chemical activator (even coming from the resin system) are required to effect an expanded basal d_{001}-spacing. It is very important to note however that high shear serves to incorporate a polar activator into the system when that activator is insoluble in the solvent or resin. Correspondingly, if the polar activator is soluble in the fluid then very little shear is necessary to swell the organoclay and thus lead to dispersion. This behavior of the model system explains why the preferred mode of utilizing conventional organoclay rheological additives is to add the organoclay to the solvent resin mixture before pigment addition to insure that a sufficient shear level is present or to prepare a pregel of organoclay and solvent before adding to the paint system. Likewise, the wisdom of the conventional practice of adding the polar activator before pigment dispersion is explained.

The Gelation Mechanism

The use of IR spectroscopy and X-ray diffraction as tools to monitor organoclay dispersion has been illustrated. Once the organoclay has been acted upon via a polar activator and dispersed by shear, two final states are possible: state (1) where the organoclay is dispersed and gelled into a network displaying rheological properties, and state (2) where the organoclay is dispersed and formed, at best into only loose agglomerates of platelets. These states can be distinguished via the magnitude of their respective viscosities (see *Table* 5, for instance). In this table, note that self-dispersing bentonite A samples 2, 3, 4, and 5 are all fully dispersed (display ~35-37 cm^{-1} infrared ½ band width) yet only sample 5 has any appreciable viscosity. Note that the self-dispersing bentonite B system, sample 13 dispersed in MIBK, has a much lower viscosity than the other samples, yet it displays the same relative ½ band width, i.e., the same relative level of dispersion. For B2MHT hectorite, samples 15-19, note that the full viscosity was only achieved after complete dispersion and addition of polar activator with water, i.e., Sample 19, where sonic energy and MeOH/H_2O were both employed. Thus, a general conclusion can be drawn that once an organoclay is fully dispersed two states are possible, (1) a gelled network or (2) a loose agglomeration of particles.

Because of the extreme importance of the gelling mechanism for a rheological additive, a detailed examination of 2M2HT bentonite and xylene was undertaken. The xylene system allows one to include three isometric versions of the solvent, ortho (O), meta (M) and para (P) to study any influence from an individual characteristic of each structure. The experimental design employed is described as follows:

Table 4—The Basal d_{001}-Spacing for Organoclays in Solvent or Resin vs Magnitude of Shear

Organoclay	Wt % Concentration	Fluid System	Incorporation Method	Polar Activator	Wt % Activator Employed	Basal d_{001} Spacing in Å
2M2Ht bentonite	100	Dry powder		None	—	25-Å
2M2Ht bentonite	4	Long oil alkyd	3 Roller mill	None	—	53-Å
2M2Ht bentonite	4	Long oil alkyd	3 Roller mill	MeOH/H_2O	1.2	52-Å
2M2Ht bentonite	4	Long oil alkyd	Dispersator	None	—	51-Å
2M2Ht hectorite	100	Dry powder		None	—	25-Å
2M2Ht hectorite	4	Short oil alkyd	3 Roller mill	None	—	47-Å
2M2Ht hectorite	4	Short oil alkyd	3 Roller mill	MeOH/H_2O	1.2	48-Å
2M2Ht hectorite	4	Short oil alkyd	Dispersator	None	—	47-Å
Self-dispersing bentonite A	100	Dry powder		None	—	38-Å
Self-dispersing bentonite A	4	Long oil alkyd	3 Roller mill	None	—	51-Å
Self-dispersing bentonite A	4	Long oil alkyd	3 Roller mill	MeOH/H_2O	1.2	52-Å
2M2Ht bentonite	8	Mineral spirits	Hand stir	None	—	25-Å
2M2Ht bentonite	8	Mineral spirits	Hand stir	MeOH/H_2O	2.4	26-Å

Table 5—Dispersion and Viscosity Development in Model Paint Systems

Sample No.	Wt % Conc.	Organoclay	Solvent	Method of Incorporation	Additional Additives	Method of Incorporating Additives	Additional Additives	Method of Incorporating Additives	Viscosity Parameters	Visc. mPa.s	Clay Band Width CM
1.....	5	Self-	Mineral	Hand stir	—	—	—	—	LVT Digital	<40	63
2.....	5	dispersing	Spirits	Cowles @ 2.7m/sec[a]	—	—	—	—	Viscometer,	<40	35
3.....	5	Bentonite		Sonic Probe	—	—	—	—	#3 probe;	<40	37
4.....	5	A		Sonic Probe	.11% H_2O	Cowles @ 2.7 m/sec	—	—	12 RPM:	<40	37
5.....	5	" "		Sonic Probe	.11% H_2O	Cowles @ 2.7 m/sec	2.28% MeOH	Cowles @ 2.7 m/sec	factor 100	1550	37
6.....	5	2M2Ht	Mineral	Hand stir	—	—	—	—	LVT Digital	<40	77
7.....	5	bentonite	Spirits	Cowles @ 2.7m/sec	—	—	—	—	Viscometer,	<40	77
8.....	5			Cowles @ 2.7m/sec	2.39% MeHO/ H_2O; 95/5 Mixture	Cowles @ 2.7 m/sec	—	—	#3 probe; 12 RPM: factor 100	1450	38
9.....	8	Self	Methyl	Hand stir	—	—	—	—	RVT Helipath	<80	43
10.....	8	dispersing	Isobutyl	Cowles @ 2.7m/sec	—	—	—	—	Viscometer,	4000	37
11.....	8	bentonite	Ketone	Cowles @ 2.7m/sec	.11% H_2O	Cowles @ 2.7 m/sec	—	—	T-B probe;	5200	36
12.....	8	B		Cowles @ 2.7m/sec	.11% H_2O	Cowles @ 2.7 m/sec	2.28% MeOH	Cowles @ 2.7 m/sec	5 RPM:	6400	37
13.....	8	" "		Cowles @ 2.7m/sec	—	—	—	—	factor 800	1840	35
14.....	8	" "		Cowles @ 2.7m/sec	.11% H_2O	Cowles @ 2.7 m/sec	—	—		3480	35
15.....	8	B2MHT	Methyl	Hand stir	—	—	—	—	RVT Helipath	<80	55
16.....	8	hectorite	Isobutyl	Cowles @ 2.7m/sec	—	—	—	—	Viscometer,	1040	32
17.....	8	" "	Ketone	Cowles @ 2.7m/sec	.11% H_2O	Cowles @ 2.7 m/sec	—	—	T-B probe;	400	26
18.....	8			Cowles @ 2.7m/sec	.11% H_2O	Cowles @ 2.7 m/sec	2.28% MeOH	Cowles @ 2.7 m/sec	5 RPM:	1040	26
19.....	8			Cowles @ 2.7m/sec	2.39% MeOH/ H_2O; 95/5 Mixture	Sonic Probe	—	—	factor 800	15600	22

(a) Peripheral speed of the impeller disc.
(b) Weight percent of the entire fluid.

93.35 g xylene (either technical grade or O,M,P) + 5.0 g 2M2HT bentonite mixed with the Dispermat for 15 min at 18 m/sec peripheral speed of the impeller disc.

Then add 1.65 g of propylene carbonate or 95/5 propylene carbonate/water, mix for 5 min at 18 m/sec. Let stand 24 hr, then measure viscosities by ramping the shearing rate from 0→1000 sec^{-1} in 10 sec, then 1000→0 sec^{-1} in 200 sec.

The results are given in *Table* 6 as samples 1-8. The previously described procedure was then modified so that four drops of water replaced the addition of the 1.65 g of propylene carbonate or 95/5 propylene carbonate/water at the 15 min mark. The amount of water is approximately equal to that which was being brought into the system by the 1.65 g of the 95/5 mixture. These samples are denoted as 9-12 in *Table* 6.

This experiment demonstrates that the use of the different isomeric versions of xylene does not significantly influence the rheological performance of the system. The maximum thickening was obtained from samples 9-12, samples in which water was the only additive to the dispersed organoclay in xylene. A significant loss of viscosity was realized with samples 5-8 when a 95/5 propylene carbonate/water mixture was added to the system. These samples demonstrate the degelling effect of propylene carbonate on the system, i.e., polar activators

Table 6—Results of Experimental Design

Sample Description	Viscosity in [mPa.s] at Various Shear Rates					
5% 2M2HT Bentonite	1000 sec^{-1}	800 sec^{-1}	600 sec^{-1}	400 sec^{-1}	200 sec^{-1}	100 sec^{-1}
(1) Xylenes + PA[a]	15	18	20	25	35	54
(2) O-xylene + PA	16	19	20	23	31	47
(3) M-xylene + PA.........	15	19	20	23	37	62
(4) P-xylene + PA	16	18	19	24	34	56
(5) Xylenes + PA/water.....	25	29	33	42	71	134
(6) O-xylene + PA/water....	33	37	42	58	103	201
(7) M-xylene + PA/water....	29	34	39	54	104	206
(8) P-xylene + PA/water	34	40	48	67	131	260
(9) Xylenes + water[b]......	118	155	199	291	544	1088
(10) O-xylene + water	108	142	183	266	508	991
(11) M-xylene + water......	124	162	209	305	580	1149
(12) P-xylene + water	86	111	141	207	398	768

(a) PA = polar activator, i.e., propylene carbonate at 33 wt % of organoclay.
(b) Water weight for samples 9-12 equals that of 5-8, i.e., .0825g's.

can degel organoclay networks. Note though that samples 1-4 had only propylene carbonate added to the dispersed organoclay and displayed the lowest viscosities. Therefore, polar activators strictly function as dispersants, not as gellants, a result also found for grease systems.

To further study this phenomenon, samples were prepared using 95 g of xylene (technical grade and isomers) plus 5 g of 2M2HT bentonite. Each sample was dispersed for 15 min at 18 m/sec after which various percentages of water were added. The weight of water added was based upon organoclay weight. Then an additional 5 min of shear at 18 m/sec was applied. The samples were allowed to equilibrate for 24 hr and viscosity measurement recorded at various shear rates. The results are found in *Table* 7. Next, 1.57 g of methanol was mixed with each sample at 18 m/sec for 3 min. The samples were again allowed to equilibrate for 24 hr before measuring viscosity at various shear rates. The 100 sec^{-1} viscosity data for the xylene/H_2O and xylene/H_2O/MeOH systems (after comporter smoothing) is presented in *Figure* 4.

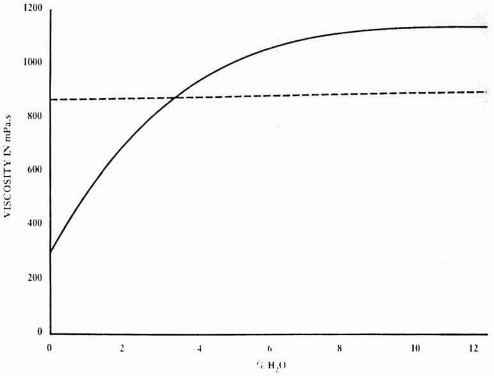


Figure 4—The 100 sec^{-1} viscosity data from *Table* 7 for the xylene/H_2O and xylene/H_2O/MeOH systems after computer smoothing of the experimental data

Data for the previously mentioned experiment listed in *Table* 7 demonstrates: (1) that an optimum amount of water is necessary to realize maximum rheological performance of the system; (2) addition of methanol to the system leads to a degelling effect; and (3) water is not a dispersant for 2M2HT organoclay.

Table 7—Results of Experimental Design

Sample Description		Viscosity in [mPa.s] at Various Shear Rates					
5% 2M2HT Bentonite	Infrared Clay Band Width, cm^{-1}	1000 sec^{-1}	800 sec^{-1}	600 sec^{-1}	400 sec^{-1}	200 sec^{-1}	100 sec^{-1}
Xylenes (no water)	34	36	47	62	92	179	339
Xylenes + 1% water	—	46	60	78	113	219	427
Xylenes + 2% water	—	73	92	120	174	333	654
Xylenes + 3% water	—	112	142	187	272	505	1027
Xylenes + 4% water	33	112	141	186	273	513	1022
Xylenes + 5% water	—	122	154	200	294	558	1099
Xylenes + 6% water	—	118	148	192	282	544	1076
Xylenes + 7% water	—	122	153	200	292	565	1103
Xylenes + 8% water	—	135	172	225	328	624	1222
Xylenes + 9% water	—	123	156	204	299	576	1131
Xylenes + 10% water	33	136	172	227	332	645	1287
Xylenes + 12% water	—	123	151	198	294	564	1125
Xylenes + 33% MeOH (no water)	38	108	136	175	245	449	867
Xylenes + 2% water + 33% MeOH	—	114	138	176	250	457	855
Xylenes + 3% water + 33% MeOH	—	117	141	180	255	478	903
Xylenes + 4% water + 33% MeOH	36	121	146	185	261	483	907
Xylenes + 5% water + 33% MeOH	—	123	149	187	266	496	934
Xylenes + 6% water + 33% MeOH	—	116	141	179	253	475	895
Xylenes + 7% water + 33% MeOH	—	123	148	187	268	506	963
Xylenes + 8% water + 33% MeOH	—	113	135	171	242	460	887
Xylenes + 9% water + 33% MeOH	—	104	126	159	227	429	833
Xylenes + 10% water + 33% MeOH	35	106	127	159	227	425	852
Xylenes + 12% water + 33% MeOH	—	117	141	180	260	500	969

(a) The percents of water and MeOH in the table are based upon organoclay weight.

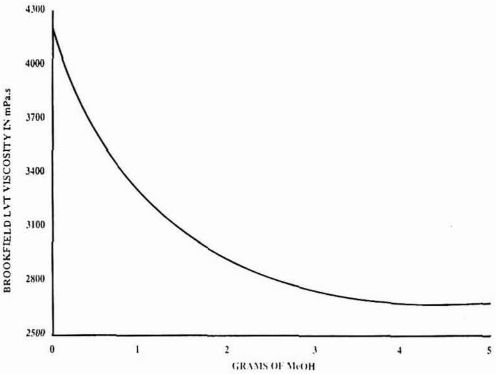


Figure 5—Degellation of 2M2HT bentonite in a long oil alkyd resin vs grams of polar activator

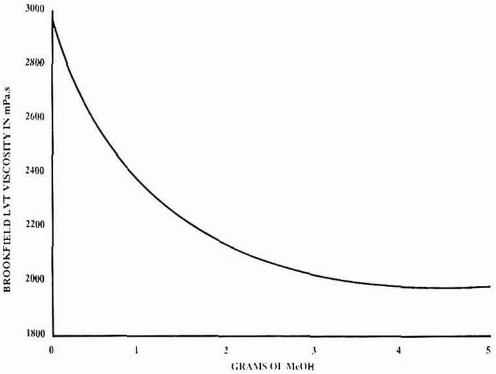


Figure 6—Degellation of self-dispersing bentonite version A in a long oil alkyd resin vs grams of polar activator

Re-examination of the data in *Table* 5 seems to suggest that H_2O *and* MeOH are necessary agents for gelling 2M2HT bentonite or self-dispersing bentonite A in mineral spirits. In previous grease studies, it was determined that polar activators such as commercial grades of methanol and acetone carried sufficient free water to form a gelled network when employed without further addition of water; and in fact, when absolute MeOH or acetone were employed only a weak gelation took place. The situation is probably analogous here, i.e., sufficient water is being brought in and "solubilized" in the system by commercial grade MeOH that a strong network results. In actuality, water is the gelling agent for these organoclays dispersed in mineral spirits and, thus, the role of MeOH upon the various experimental combination shown in *Table* 5 is strictly to "solubilize" H_2O.

Potential for Degelation

What is the effect of MeOH/H_2O as a polar activator when added to a completely dispersed organoclay in a resin paint system? To answer this question, 2M2HT bentonite and self-dispersing bentonite A were dispersed in their respective resin system with MeOH/H_2O polar activator using a three roller mill. The combination of extremely high shear and polar activation lead to complete dispersion as was confirmed by infrared band width measurements. Each organoclay/resin system was then spread out as a thin film in a glass tray and heated at 65°C for three days in a forced air oven to remove polar activator and solvent. A nitrogen atmosphere was used in the oven to retard the crosslinking of the resin. When the polar activator had evaporated from the system, the resulting material was a completely dispersed organoclay in a high solids resin with no polar activator or solvent present. This material was redispersed in solvent and initial viscosity recorded. Tha sample was then titrated with polar activator and viscosity measurements recorded after each addition of titrant. A curve of the viscosity measurements was plotted against amount of polar activator added (*Figures* 5 and 6). Here the viscosity was seen to continuously drop as the amount of activator continuously increased. This experiment demonstrates that once any type of organoclay is completely dispersed in a resin or solvent, addition of polar activator immediately begins to degel the system. Thus, polar activators are necessary dispersing aids for conventional organoclays when employed in paints and coatings but they also simultaneously cause some degelation of the organoclay platelet network. This polar activator/degelling mechanism is one drawback to employing conventional organoclays in resins, solvents, or paints.

Rate of Dispersion

Samples of 2M2HT bentonite and self-dispersing bentonite A were prepared by hand stirring 10 wt % solids into mineral spirits and recording infrared ½ band widths. Each sample was then sheared using a Premier mill equipped with a Cowles blade at a shear rate of 2.25 m/sec for various lengths of time. Samples were taken and infrared spectra were recorded on each sample. Clay band width measurements were recorded to monitor the rate of dispersion of the two organoclays with time. The rate of dispersion versus time of shearing is presented in *Figure* 7. The two respective curves clearly illustrate the advantage of self-dispersing organoclays, i.e., the self-

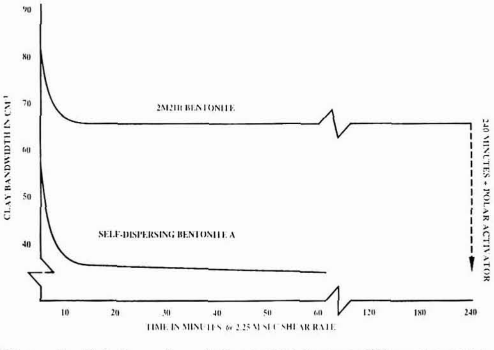


Figure 7—Relative rates of dispersion for two different organoclays vs time at a fixed shear rate

dispersing material has reached full rheological potential within 10 min of incorporation without any external activation whereas the conventional product (2M2HT bentonite) even after four hours had not completely dispersed. After the four hour period, a 3.3 wt % addition of MeOH/H_2O (95/5) and additional five minutes of shearing lead to a final band width closely approximating that of the self-dispersing organoclay, i.e., the same relative degrees of dispersion.

CONCLUSIONS

The behavior of organoclay rheological additives in coatings systems are similar in many respects to the results obtained in grease systems. For instance, milling (mechanical work) of an organoclay in grease caused the separation of organoclay platelet stacks into smaller stacks while polar activation increased the basal d_{001} spacing between the platelets within an individual stack. The narrowing of the infrared clay band width confirmed the increased d_{001}-spacing with the addition of polar activator. In a paint/resin system, milling had the same effect on the platelet stacks, but a polar activator was not necessary for increasing the basal d_{001}-spacing since a specific component of the resin served to activate the organoclay. Measurement of IR clay band widths in the infrared proved to be a useful tool in determining relative organoclay dispersion in resins or solvents. Infrared clay band widths collapsed as organoclay dispersion increased.

The MeOH fraction of MeOH/H_2O polar activator acted predominantly as a vehicle to introduce water (a strong hydrogen bonder) into a paint type system where water would be naturally insoluble. Once the water was solubilized in the system, it formed a hydrogen bond network between dispersed organoclay platelets leading to rheological activity. However, if an amount of activator excessive to that required to solubilize water was added to an already dispersed organoclay system, the excess activator interfered with the hydrogen bonding network and caused degelation. Water was found to be a gel promoter, and not to be a dispersant, and must be present or no network possessing rheological activity will result. The contrasting behavior between H_2O and polar activators clearly established that gelation and dispersion are two independent phenomena.

These findings have promoted new technology leading to the commercial development of self-dispersing organoclay product lines. This technology is based on proprietary chemical methods for increasing the basal d_{001}-spacing of organoclays in the dry state and therefore increasing dispersibility, via the rate of dispersion, of the organoclay.

Paint systems can be characterized as a complex mixture of many components, the self-dispersing products are able to utilize one or more components of the paint system to form a gel network. These components cannot be utilized by conventional organoclay products without the addition of polar activators to promote dispersion. Since with the new technology no polar activator is present to lessen the strength of the gel structure, the self-dispersing technology allows the coatings manufacturers to achieve the maximum rheological benefits of the organoclay additive with a minimum of formulating adjustments.

ACKNOWLEDGMENT

We would like to thank NL Chemicals, Inc. for providing support instrumentation and time to carry out this project.

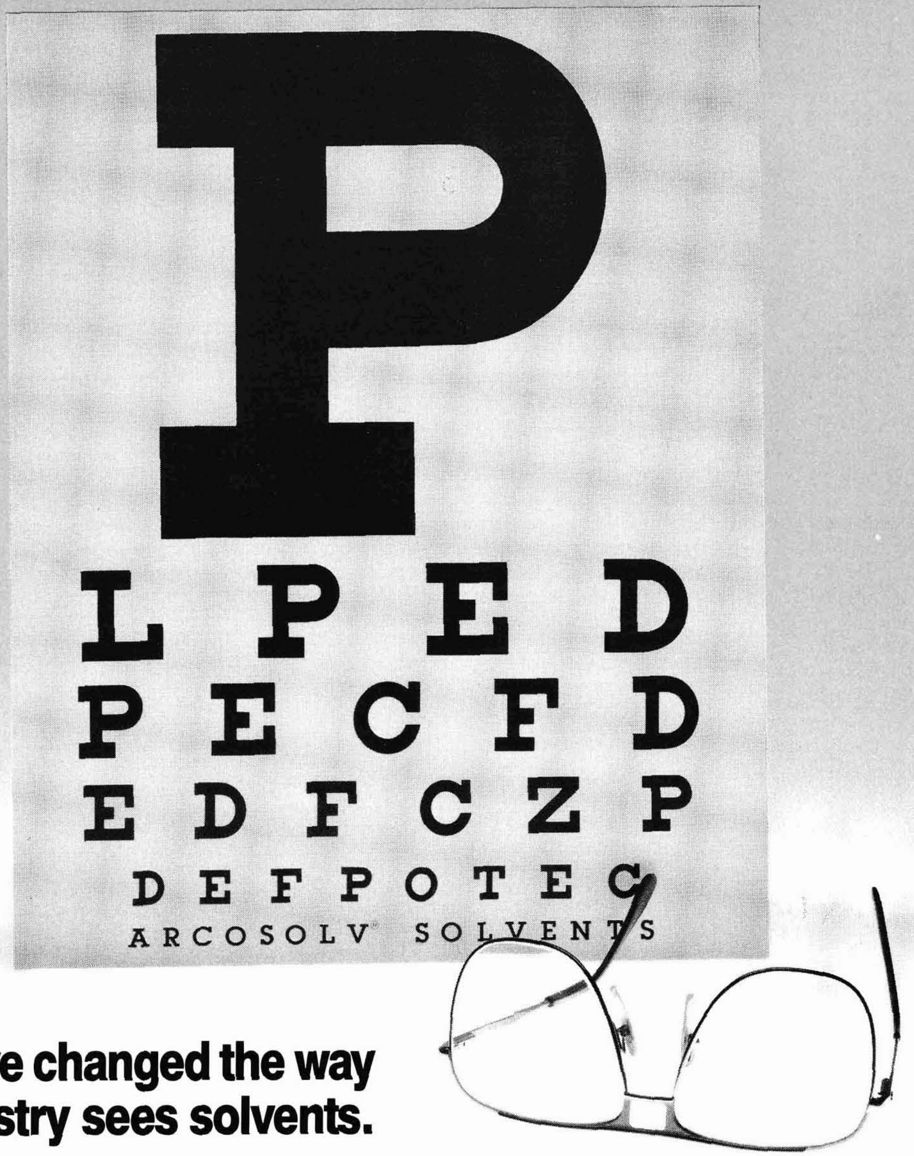
References

(1) Cody, C.A. and Reichert, W.W., "Studies of Fundamental Organoclay Rheological Relationships," 51st Annual Meeting of the National Lubricating Grease Institute, October 28-31, 1984, Phoenix, AZ.

(2) Magauran, E.D., Chiavoni, A., Reichert, W.W., and Cody, C.A., "Studies of the Behavior of Dispersed Organoclays in Grease Systems," 52nd Annual Meeting of the National Lubricating Grease Institute, October 27-31, 1985, Hot Springs, VA.

(3) Magauran, E.D., Kieke, M.D., Reichert, W.W., and Chiavoni, A., "Effective Utilization of Organoclay Dispersion Behavior During Grease Manufacture," 53rd Annual Meeting of the National Lubricating Grease Institute, October 29-31, 1986, San Diego, CA.

(4) Brookfield Engineering Labs, Inc., Dept. AA-2, 240 Cushing St., Staughton, MA 02072.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Surface Studies of Titanium Dioxide Pigments

Tuomo Losoi
Kemira Oy*

The surfaces of alumina-, silica-, and alumina-silica-coated TiO_2 pigments were studied with zeta potential (ZP), X-ray photoelectron spectroscopy (XPS), and secondary ion mass spectroscopy (SIMS) measurements. The differences in the isoelectric points (IEP) of alumina-silica-coated pigments derived from the ZP curves illustrated clearly whether the uppermost layers of the coatings were dominated by alumina or silica. The elemental compositions of surface layers obtained from XPS and SIMS experiments suggested different coating methods for pigments with similar bulk analyses. All the methods used confirmed that the hydrous oxides of Al and/or Si covered the base TiO_2 crystals instead of being loose compounds between the crystals. The surface analytical results were used in a study of dispersion stability of TiO_2 water-borne formulations.

INTRODUCTION

Most of the commercial TiO_2 pigments are surface treated with hydrous oxides of Al, Si, P, Zn, Zr, etc., in order to reduce the photocatalytic effect of TiO_2 in paints and to enhance the dispersibility into binders.[1,2] The dispersion stability of water-borne formulations of TiO_2 also greatly depends on the surface treatment.[3,4]

The patent literature of TiO_2 is rich in examples of surface treatment techniques and, as a result, similar TiO_2 pigments may give different results with the same formulation. Thus, the surface characterization of pigments has an important role in studies which aim to explain the behavior of TiO_2 in its application environment.

Hydrous alumina and silica are the most common coatings on TiO_2 surfaces. Electrophoretic mobility and zeta potential (ZP) are widely used for the surface characterization of these pigments, owing to the difference in the isoelectric points (IEP) of alumina and silica.[5] However, ZP is sensitive to experimental conditions, and if substances other than alumina and silica are used, differences between pigments can be difficult to distinguish. X-ray photoelectron spectroscopy (XPS) and secondary ion mass spectroscopy (SIMS) are modern surface analytical techniques which provide an elemental surface composition originating from a depth of 1-3 nm.[6,7]

The purpose of this work is to show the suitability of ZP, XPS, and SIMS for the surface characterization of coated TiO_2 pigments and to give, with the help of simple dispersion stability studies, examples of where to use surface analysis data.

EXPERIMENTAL

The uncoated TiO_2 substrate made by the sulphate process was dispersed in deionized water at a concentration of about 200 gdm^{-3} at pH 9. The slurry was heated to 322 K and stirred throughout the deposition stages of hydrous oxides. Required reagents for the surface treatment of the base TiO_2 were added to the slurry over 60 min and the resulting slurry was neutralized with H_2SO_4 or NaOH to pH 7. Solutions of $Al_2(SO_4)_3$ and $NaAlO_2$ were used for Al_2O_3-coated TiO_2 and Na_2SiO_3 solution for SiO_2-coated TiO_2. $Al_2(SO_4)_3$ and $NaAlO_2$ were the Al_2O_3 sources in the A and B series of mixed oxide coatings of Al_2O_3 and SiO_2, respectively, and the precipitation procedure was analogous to that of Bruni et al.[8] Layer coated samples were made first by precipitating one coating component on TiO_2 crystals and then introducing another treatment chemical simultaneously, with acid or base in order to keep the pH at 6-8. Al_2O_3 was

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Presented by Mr. Losoi, on behalf of the Scandinavian Paint and Varnish Technologists, at the 66th Annual Meeting of the Federation of Societies for Coatings Technology, in Chicago, IL, on October 20, 1988.

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precipitated on SiO_2-coated TiO_2 in the C series and SiO_2 on Al_2O_3-coated in the D series. All samples were recovered from their slurries by filtering. Soluble salts were washed with deionized water and solids were dried for 16 hr at 377 K and finally jet milled. Characteristics of some samples are given in *Table* 1.

The amount of coating chemicals varied from 3-13 wt %. Pigment 2 is Al_2O_3-coated TiO_2 and is meant for high gloss applications. Sample 3 is SiO_2-coated TiO_2 with the surface treatment level of pigment 2. It was included in this study as a reference sample and has no commercial interest. Pigment 6A is a heavily coated TiO_2 with high silica content—three times more than in sample 3—and is designed for high PVC formulations. SiO_2 content of samples 4A-4D which are often used in flat alkyd paints was about the same as that of pigment 3. 5A is an intermediate pigment between samples 4A-4D and 6A.

ZP measurements were carried out with a Malvern Zetasizer II in 0.001 $moldm^{-3}$ KCl solutions. KOH and HCl were used for pH adjustments. 0.001 $moldm^{-3}$ KNO_3 was used as an electrolyte in addition to KCl in some experiments, but no differences in the results were seen.

XPS spectra were recorded with a VG ESCA 3 (University of Turku, Finland) by using Mg K_α radiation at a pressure of ca. 10^{-7} Pa. SIMS spectra were obtained by courtesy of Perkin-Elmer Corporation (PHI 6300 Secondary Ion Profiler).

Adsorption isotherms of NaOH neutralized polyacrylic acid (SPA) with M_w of ca. 3500 on treated TiO_2 surfaces were determined using the procedure given in *Figure* 1.[4] The amount of adsorbed SPA was calculated by the concentration difference between the solute added into TiO_2 slurries and the supernatant after removal of the solids by centrifugation. SPA in the supernatant was analyzed by UV spectroscopy (PYE UNICAM PU 8800 UV/VIS spectrophotometer). TiO_2 content of slurries was 35 wt %, temperature 300 K, and final pH after 20 hr agitation in the range 5.3-5.6 and 8.1-8.3.

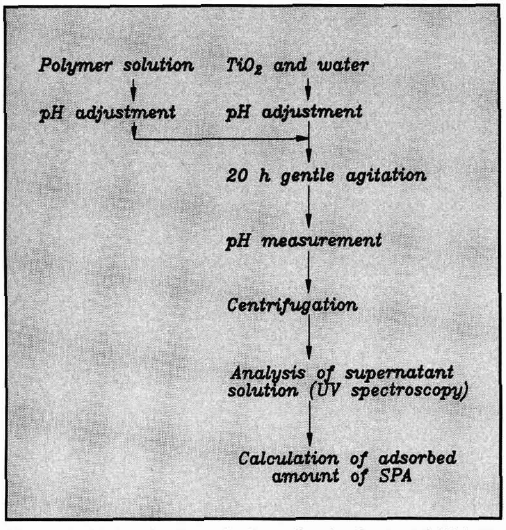

Figure 1—Determination of adsorption isotherms of SPA on treated TiO_2 surfaces

Table 1—Characteristics of TiO_2 Samples

Pigment	Coating Type	$Al_2O_3/(Al_2O_3+SiO_2)$ (wt % ratio)	Isoelectric Point
1	uncoated	–	3.8
2	I[a]	1.0	8.1
3	II[b]	0.0	2.0
4A	III[c]	0.63	6.8
4B	III	0.63	6.1
4C	IV[d]	0.64	7.4
4D	V[e]	0.66	4.5
5A	III	0.49	5.1
6A	III	0.33	2.5

(a) I = Al_2O_3.
(b) II = SiO_2.
(c) III = mixed oxides of Al_2O_3 and SiO_2.
(d) IV = layer coating: Al_2O_3 on SiO_2.
(e) V = layer coating: SiO_2 and Al_2O_3.

The storage stability of dispersions was assessed by simple viscosity measurement (Brookfield RVF 100, 20, and 100 rpm). The TiO_2 content of slurries was 50 wt %, pH 5.0-5.3 and 8.4-9.0, and temperature 300 K. The procedure for making slurries was analogous to that of the adsorption measurements. The amount of SPA added was from 0 to 2.75 wt %/TiO_2. Pigments were dispersed with the help of a Dispermat CV dissolver (2500 rpm, 3 min).

White emulsion paints were also made using commercial TiO_2 pigments with varying Al_2O_3/SiO_2 ratios and different SPA amounts. Details of formulations are given elsewhere.[4] The storage stability of these paints was followed by a Brookfield RVTDVII viscometer at 10, 20, 50, and 100 rpm.

RESULTS AND DISCUSSION

Zeta Potential of TiO_2

The zeta potential curves vs pH of different TiO_2 pigments are shown in *Figure* 2a. Alumina surface treatment shifts the IEP of the substrate rutile from 3.8 to 8.1, indicating the formation of a true coating on TiO_2. Silica has an analogous effect, and the IEP of pigment 3 resembles that of pure silica. Pigments having a mixed oxide coating of alumina and silica fall between samples 2 and 3. Changes in the $Al_2O_3/(Al_2O_3 + SiO_2)$ ratio or in the precipitation order of coating substances affect the IEP significantly. Thus, ZP is useful for a qualitative characterization of Al_2O_3-SiO_2-coated pigments.

Precipitation of coating chemicals on TiO_2 surfaces was followed by taking intermediate samples from TiO_2 slurries at various pH and analyzing them by X-ray fluorescence (XRF) and ZP. The measured ZP curves of the extracted samples illustrated the formation of coatings on TiO_2. *Figure* 2b shows the ZP graphs of sample 6A and its intermediate samples taken at pH 3.6, 4.4, 5.0, and 7.8. Al_2O_3 and SiO_2 analyses of 6A and the intermediates at pH 4.4, 5.0, and 7.8 were equal and similar ZP results could be expected. However, the measured ZP graphs in

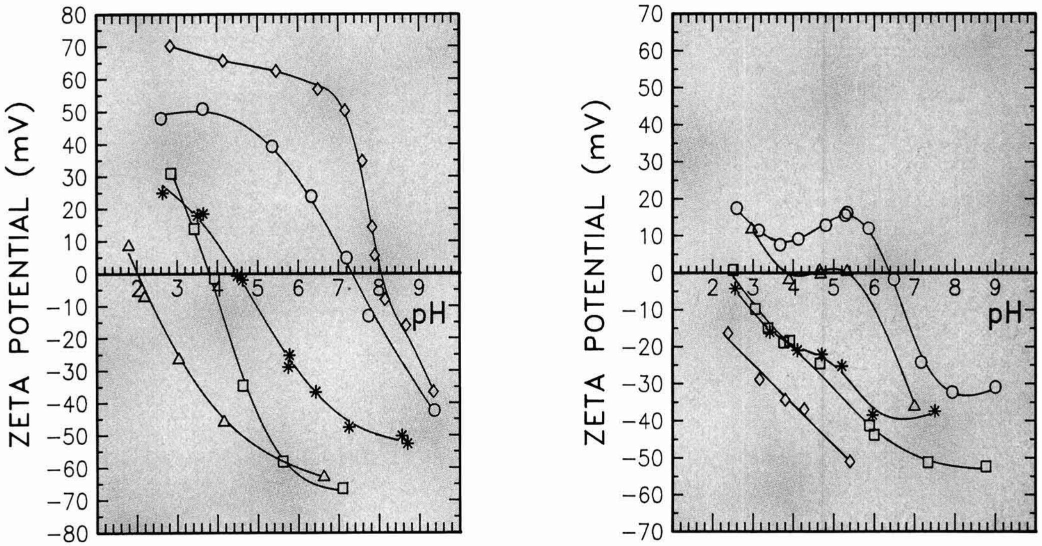

Figure 2—Zeta potentials vs pH of TiO_2 pigments. A: □ pigment 1, ◇ pigment 2, △ pigment 3, ○ pigment 4C, ★ pigment 4D. B: □ pigment 6A, ◇, △, ○, ★ intermediate samples of 6A taken from the slurry at pH 3.6, 4.4, 5.0, and 7.8, respectively

Figure 2b show tremendous differences between the samples. This can be due to the presence of a hydrous alumina layer or the adsorption of a polymeric aluminum ion on the highly SiO_2-treated pigment surface at pH 4.4 and 5.0. The latter is probably $Al_8(OH)_{20}^{4+}$, which appears in the pH range 4-7.[9]

Since the IEP decreases from 6.4 to ca. 2 as the neutralization of the TiO_2 slurry reaches pH 8, the high IEP value may result mainly from $Al_8(OH)_{20}^{4+}$ adsorption. The difference between the finished pigment 6A and the intermediate at pH 5.0 was verified by measuring the amount of sodium polyacrylate (SPA) adsorbed on particular pigments. In the case of 6A, the uptake of SPA was much less than that of the intermediate.

XPS Studies of TiO_2

The wide scan XPS spectra of uncoated (pigment 1) and Al_2O_3-SiO_2-coated (pigment 4C) TiO_2 samples are shown in *Figure* 3. The binding energies of Al 2p, Si 2p, and Ti $2p_{3/2}$ were ca. 74, 102, and 458.5 eV, respectively, suggesting the elements to be in an oxide form.[10] *Table* 2 contains surface compositions (elemental form) of some samples given in relative atomic percentages. Decreasing Al_2O_3/SiO_2 ratio (*Table* 1) causes the surface concentration of Al to decrease and that of Si to increase as expected. The correlation justifies the use of XPS for the surface characterization of coated TiO_2 pigments.

XPS spectra of Al_2O_3-treated TiO_2 (pigment 2) showed the presence of S 2p at 169 eV in addition to Al, Ti, and O as in the case of the pigment 4C in *Figure* 3. Howard and Parfitt recorded a similar binding of S as sulphate ions to aluminum ions by elemental analysis, when the Al_2O_3 coating was made from $Al_2(SO_4)_3$ solutions.[5] O 1s signal of SiO_2-treated TiO_2 (sample 3) consists of a distinctive duplet at 530.0 and 532.9 eV. The peak related to the lower binding energy is due to the oxygen photoelectrons of TiO_2 and the signal at 532.9 eV results from those of SiO_2. The duplet reveals the SiO_2 coating to be thin or incomplete in some areas. XPS spectra of mixed oxide-coated TiO_2 samples showed differences originating from the precipitation methods. When $Al_2(SO_4)_3$ was used as the Al_2O_3 source, the spectra included, in some cases, the sulphur peaks S 2p and S 2s but no signs of Na. Na 1s at

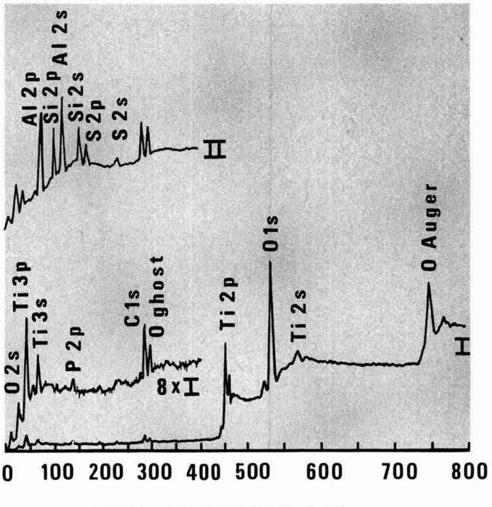

Figure 3—XPS spectra of TiO_2 pigments. I: pigment 1. II: pigment 4C

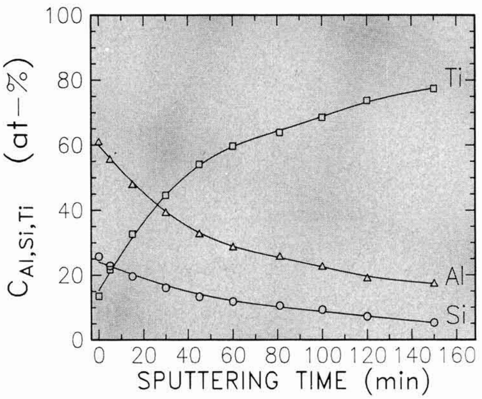

Figure 4—Depth profile of pigment 4A

1073 eV and the Auger peak $KL_{23}L_{23}$ at ca. 264 eV always appeared when $NaAlO_2$ was added into slurries instead of $Al_2(SO_4)_3$ and was precipitated with SiO_2. No S signals were observed in these cases. Na peaks seem to suggest that the coatings of the B series consist of sodiumaluminumsilicate. Depending on the SiO_2 and Al_2O_3 content, the outer layers of coatings can be dominated by SiO_2 or Al_2O_3. This was confirmed by XRF analyses of the intermediate samples extracted during the precipitation process of $NaAlO_2$ and Na_2SiO_3. The first samples taken at the pH range of 12-13 had a SiO_2/AlO_3 ratio of about 2, and, as the neutralization went further, the surface was enriched with Al_2O_3 or SiO_2. The results are consistent with those of Bruni, et al.[8]

The IEP of surface-treated pigments indicated that the coating substances cover the substrate. A comparison between coating/substrate atomic ratios derived from XRF and XPS measurements supported this indication. The XPS ratios were ca. two orders of a magnitude higher than those calculated from XRF results.

Pigment surfaces were sputtered using argon-ion bombardment in order to get an elemental distribution of coatings. *Figure* 4 illustrates the depth profile of sample 4A. It obeys the theoretical depth profile model for a coated spherical particle given by Cross and Dewing.[11] The effect of the TiO_2 core becomes gradually more dominant and the concentration of the Al_2O_3-SiO_2 skin decreases smoothly as a function of the sputtering time. Al_2O_3 is concentrated on the top layers of the coating. When the coating is etched, SiO_2 content does not increase as it should. A similar result was obtained in the case of pigment 4C. Furthermore, the depth profile of pigment 4D was almost a copy of that of pigment 4C. Deliberately made layer coating structures were not detected by depth profiling.

SIMS Studies of TiO_2

Positive SIMS spectra of coated TiO_2 pigments are given in *Figure* 5. The dominant peak of Al_2O_3-treated TiO_2 (sample 2) is Al27 and those of SiO_2-treated pigment (sample 3) Na23 and Si28. Ti signals are also prominent. The peak $m/e = 27$ in *Figure* 5b is due to the Al_2O_3 used for the crystal modification of the substrate TiO_2. Signals of elements such as Mg, K, and Ca, which are present at ppm levels and were not observed in the XPS spectra, demonstrate the sensitivity of SIMS. On the other hand, sulphur was not recorded in *Figure* 5a contrary to the corresponding XPS spectrum. This is an example of a disadvantage of SIMS—elements have different secondary ion yields, which complicates the quantification of the results.

Coating/substrate ratios derived from peak intensities confirmed that the coating compounds lie on TiO_2 surfaces. The detection of the trace elements originating from the TiO_2 substrate shows, furthermore, that the coating layers can be thin or patchy. The depth profiles of pigments 4C and 4D were measured in order to show the Al_2O_3 and SiO_2 distribution within the coating, but as in the case of the XPS experiments, only slight differences between the samples were seen.

ZP vs XPS and SIMS

ZP measurements depend greatly on experimental conditions such as electrolytes[12] and specific adsorption of ions,[13] and contradictory results can be obtained. However, the present study showed that ZP is a method worthy of consideration for the surface characterization of Al_2O_3-SiO_2-coated TiO_2 pigments. It responded easily to changes in the Al_2O_3/SiO_2 ratio of outer surface layers as seen in *Figure* 2. It was surprising to find that XPS and SIMS did not distinguish pigments 4C and 4D from each other in any other respect than in S and Na contents. The surface Al_2O_3/SiO_2 ratios of these samples were the same

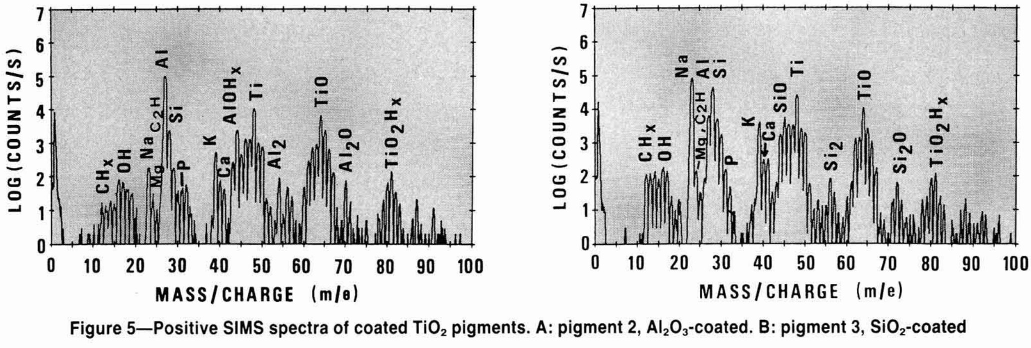

Figure 5—Positive SIMS spectra of coated TiO_2 pigments. A: pigment 2, Al_2O_3-coated. B: pigment 3, SiO_2-coated

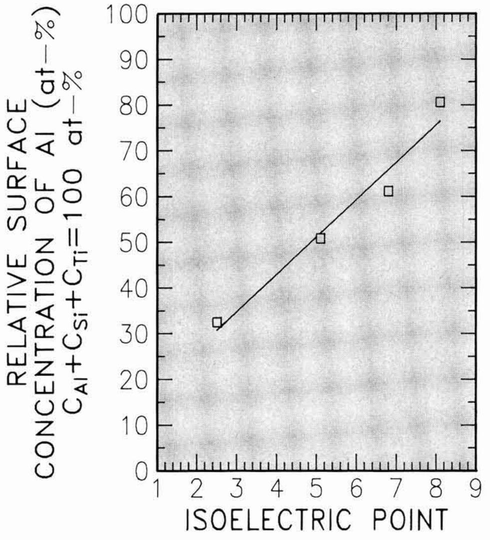

Figure 6—Surface Al_2O_3 concentration in elemental form as a function of isoelectric point

although the difference in the isoelectric points was ca. 3 pH units. Probably the SiO_2 coating on the Al_2O_3 layer of pigment 4D was again thin or irregular and the escape depth of Al photoelectrons was too high, thus masking the difference. When more SiO_2 is precipitated on Al_2O_3-coated TiO_2, the surface Al_2O_3/SiO_2 ratio reacts also to the presence of the SiO_2 layer on the Al_2O_3-coating.

Figure 6 illustrates the relation between the relative surface Al_2O_3 concentration in elemental form and the IEP of TiO_2 samples, which were surface treated using the same technique with varying SiO_2 contents. It can be seen that XPS and ZP results are consistent with each other. When the precipitation order of coating compounds was changed, the linearity between the surface Al concentration and the IEP disappeared.

Application of Surface Studies

Results obtained from the above-mentioned surface analyses were utilized in a study of the dispersion stability of water-borne formulations.[4] The viscosity stability of slurries based on TiO_2 pigments with varying Al_2O_3/SiO_2 ratios was followed as described in the Experimental section. SPA was used as a dispersing agent. *Figure* 7 shows the obtained viscosity graphs for two TiO_2 pigments with similar bulk analyses of alumina and silica. *Table* 3 gives the surface characteristics of these pigments. Al_2O_3 is undoubtedly concentrated on the outermost layers of pigment A according to both XPS and ZP analyses. The IEP of pigment B reveals SiO_2 to be a dominant component on the top surface. The XPS composition is also different from that of sample A, although the Al_2O_3 content is still considerable.

Table 2—Relative Surface Atomic Composition in Elemental Form of TiO_2 Pigments (at %)

Sample	Al at %	Si at %	Ti at %
2.	80.6	—	19.4
3.	—	64.1	35.9
4A	61.1	25.6	13.3
5A	50.8	42.0	7.2
6A	32.5	55.7	11.8

Table 3—Surface Characteristics of TiO_2 Pigments Related to *Figure* 7

		XPS			ZP	
Sample	$Al_2O_3/(Al_2O_3+SiO_2)$ (wt % ratio)	Al at %	Si at %	Ti at %	Isoelectric Point	Specific Surface m²/g
A	0.63	62.4	29.4	8.2	7.4	20
B	0.57	43.8	47.7	8.5	2.8	19

Anionic polyelectrolytes of polycarboxylic acid type are often used in water-borne applications, since they are adsorbed on pigment surfaces and increase electric repulsion between pigment particles.[3] The amount of adsorbed surfactant depends, among other things, on the surface chemical nature of the pigment. Viscosity measurements with 20 and 100 rpm in *Figures* 7a and 7c show that the slurry pigmented with TiO_2 having Al_2O_3 on the outermost layer requires ca. three times more SPA to be stable than that based on the pigment with considerable SiO_2 enrichment. The interaction between SPA and the pigment surface is explained by the surface charge. When Al_2O_3 dominates the surface, ZP is positive over a wide pH range, and the adsorption below the IEP is due to the electric attraction between positively charged surface sites of the coating and the negatively charged functional groups of the polymer. Increasing the SiO_2 content causes the surface charge to become less positive or negative and the adsorption of SPA decreases because of electric repulsion. The relation between the surface charge and SPA adsorption was verified by measuring the corresponding viscosity curves (20, 100 rpm) and pH 5.0-5.3. The amount of SPA needed to stabilize the slurries was now considerably higher, since the pigments were more positively charged than at pH 8.4-9.0.[4]

Adsorption isotherms for SPA on TiO_2 pigments in *Table* 3 were measured at pH 5.3-5.6 and 8.1-8.3 (*Figure* 8). The difference in the amount of adsorbed SPA between the samples is in agreement with the conclusions drawn from the viscosity studies. The level of SPA needed to saturate pigment surfaces (points in the beginning of the plateau region of the isotherms) and that required for stable viscosities was practically the same in both cases. It must be pointed out that SPA was adsorbed at pH above the IEP of the pigment. One explanation is that the pigment coating consists of oxides with different IEP and the coating can have both positively and negatively charged

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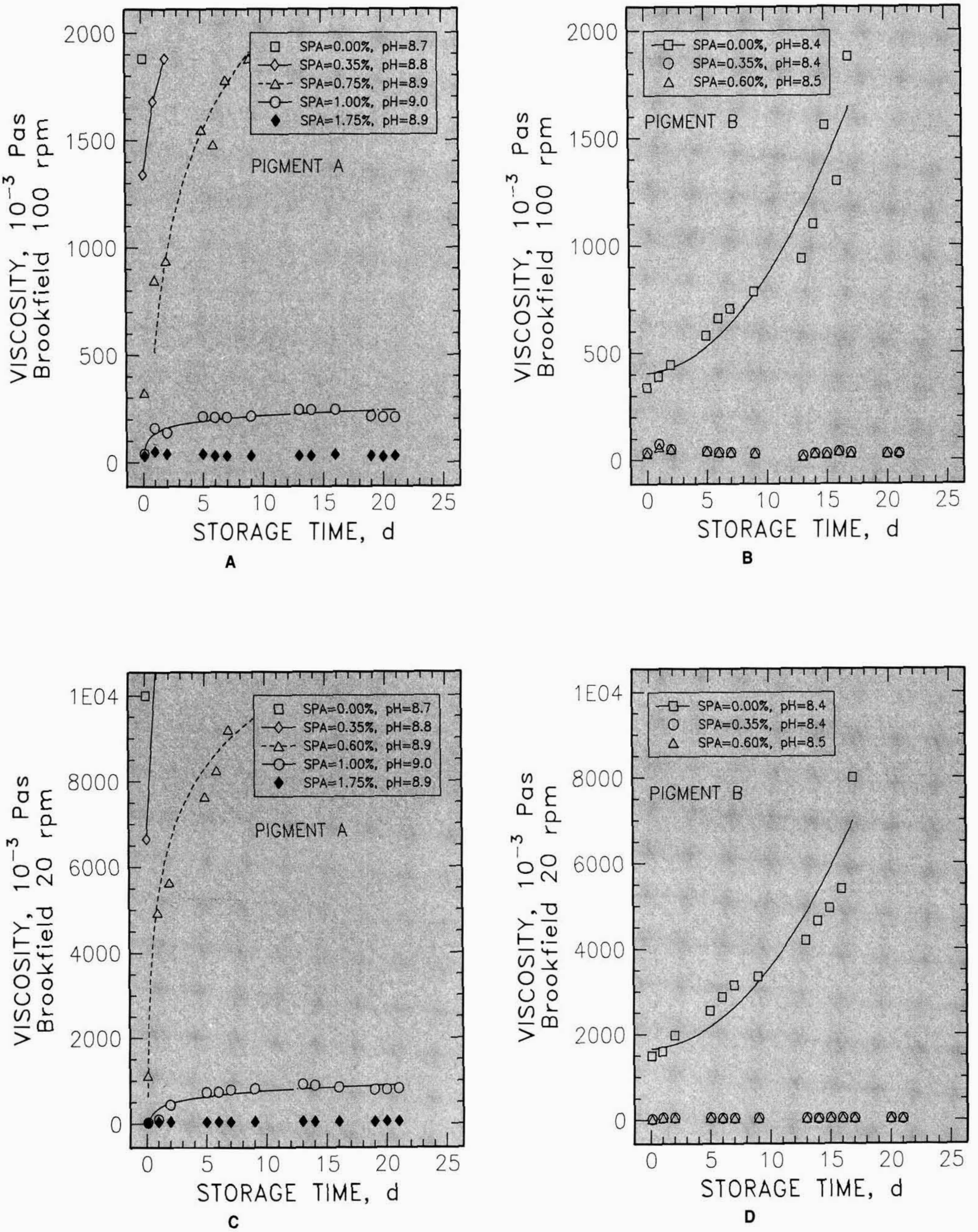

A **B** **C** **D**

Figure 7—Viscosity stability of TiO_2 pigmented slurries as a function of time with different SPA additions (wt %), 50% solids, T 300 K, pH 8.4-9.0, and pigment characteristics in *Table* 3. A: pigment A, viscosity at 100 rpm. B: pigment B, viscosity at 100 rpm. C: pigment A, viscosity at 20 rpm. D: pigment B, viscosity at 20 rpm

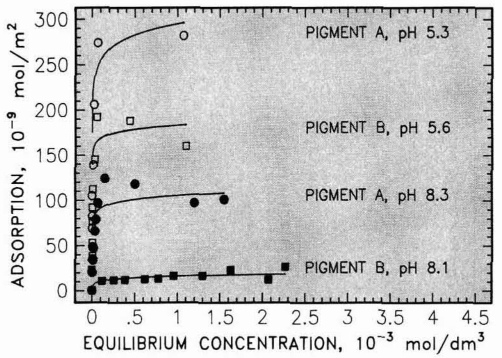

Figure 8—Adsorption isotherms for SPA at different pH on coated TiO_2 pigments. Pigment characteristics in *Table* 3

sites. The measured zeta potential gives the net charge, which allows some positive Al_2O_3 sites to exist above the IEP and SPA to be adsorbed onto these sites. The situation is analogous to a study which reported the adsorption of sodium dodecyl sulphate on Al_2O_3 surfaces above the IEP.[14] Further information on SPA adsorption on coated TiO_2 pigments is given in reference (4).

White emulsion paints using commercial TiO_2 pigments with different Al_2O_3/SiO_2 ratios and SPA additions were made to further show the importance of the surface chemical nature of pigments in water-borne systems.[4] The storage stability of the paints based on viscosity data agreed with the conclusion previously given of the close relationship between the surface composition of TiO_2 and SPA.

The conclusions from the brief review to the dispersion stability and SPA adsorption using pigments A and B also prevail in other cases, where the Al_2O_3/SiO_2 ratio of the coating varies from 0 to 1.[4] Al_2O_3-SiO_2 coatings can be either co- or layer-precipitated.

SUMMARY

The surfaces of coated TiO_2 pigments have been analyzed with zeta potential (ZP), X-ray photoelectron spectroscopy (XPS), and secondary ion mass spectroscopy (SIMS) measurements.

The study showed that ZP is a method worthy of consideration for the surface characterization of Al_2O_3-SiO_2-coated TiO_2 pigments, since it responds easily to changes in the Al_2O_3/SiO_2 ratio of outer surface layers. XPS and SIMS provided elemental surface compositions of outermost coating layers, which revealed some differences in the preparation methods of coatings. The shift from the isoelectric point (IEP) of uncoated TiO_2 to those of coated samples and the coating/substrate ratios derived from the XPS and the SIMS spectra indicated the formation of true coating skins on the TiO_2 core. However, both the XPS and the SIMS spectra included a significant contribution of TiO_2, which meant the coatings were thin and/or patchy in some areas. The depth profiling (XPS, SIMS) showed the elemental distributions within the coating layers, however, it failed to distinguish the pigments which shared similar bulk analyses but had a difference of ca. 3 pH units in their IEP. Taken as a whole, ZP, XPS, and SIMS results supported each other.

The need for the surface characterization of coated pigments by ZP and XPS was shown in a dispersion stability study of slurries. In the case of surface-treated TiO_2 and sodium polyacrylate (SPA), the surface of a pigment had to be saturated with SPA to ensure the longest storage time. Bulk Al_2O_3/SiO_2 ratio and especially that of outer surface layers has a strong effect on the amount of SPA needed for surface saturation. Two pigments with similar bulk coating composition but with different surface contents illustrated the impact of these ratios on viscosity stability.

ACKNOWLEDGMENT

The author would like to thank the management of Kemira's TiO_2 group for permission to publish this paper, Prof. E. Suoninen and Mr. M. Heinonen for their guidance in the use of XPS equipment, Mr. J. Newman for SIMS experiments, and Mr. P.O. Mäkinen and Mr. A. Kohonen for helpful discussions.

References

(1) Simpson, L.A., "Influence of Titanium Dioxide Pigment on Durability of Paint Films," *Polymers Paint Colour J., 176,* No. 4168, 408 (1986).

(2) Simpson, L.A., "Influence of Titanium Dioxide Pigment on the Surface Roughness of Organic Coatings," *J. Oil & Colour Chemists' Assoc., 69,* No. 9, 232 (1986).

(3) Morrison, W.H., Jr., "Stabilization of Aqueous Oxide Pigment Dispersions," JOURNAL OF COATINGS TECHNOLOGY, *57,* No. 721, 55 (1985).

(4) Mäkinen, P.O., Losoi, T., and Kohonen, A., "Stability of Aqueous Dispersions of Titanium Dioxide," *12th Congress of the Federation of Scandinavian Paint and Varnish Technologists. Congress Book,* pp 8.1-8.18, May 9-11, 1988, Helsinki, Finland.

(5) Howard, P.B. and Parfitt, G.D., "The Precipitation of Silica/Alumina on Titanium Dioxide Surfaces," *Croat. Chem. Acta, 50,* No. 1-4, 15 (1977).

(6) Hercules, D.M. and Hercules, S.H., "Analytical Chemistry of Surfaces, Part II. Electron Spectroscopy," *J. Chem. Educ., 61,* No. 6, 483 (1984).

(7) Hercules, D.M. and Hercules, S.H., "Analytical Chemistry of Surfaces, Part III. Ion Spectroscopy," *J. Chem. Educ., 61,* No. 7, 592 (1984).

(8) Bruni, M., Visca, M., Garbassi, F., and MelloCeresa, E., "Precipitation of Aluminosilicates on the Surface of Titanium Dioxide," *Ind. Eng. Chem. Prod. Res. Develop., 24,* No. 4, 579 (1985).

(9) Matijevic, E., Mathai, K.G., Ottewill, R.H., and Kerker, M., "Detection of Metal Ion Hydrolysis by Coagulation. III. Aluminum," *J. Phys. Chem., 65,* 826 (1961).

(10) Wagner, C.D., Riggs, W.M., Davis, L.E., Moulder, J.F., and Muilenberg, G.E., *"Handbook of X-ray Photoelectron Spectroscopy,"* Perkin-Elmer, Eden Prairie, MN (1979).

(11) Cross, Y.M. and Dewing, J., "Thickness Measurements on Layered Materials in Powder Form by Means of XPS and Ion Sputtering," *Surface Interface Anal., 1,* No. 1, 26 (1979).

(12) Tschapek, M., Wasowski, C., and Torres Sanchez, R.M., "The P.Z.C. and I.E.P. of γ-Al_2O_3 and TiO_2," *J. Electroanal. Chem., 74,* No. 2, 167 (1976).

(13) Jang, H.M. and Fuerstenau, D.W., "The Specific Adsorption of Alkaline-Earth Cations at the Rutile/Water Interface," *Colloids Surface., 21,* 235 (1986).

(14) Bitting, D. and Harwell, J.H., "Effects of Counterions on Surfactant Surface Aggregates at the Alumina/Aqueous Solution Interface," *Langmuir, 3,* No. 4, 500 (1987).

Plasma Surface Treatment of Polypropylene-Containing Plastics

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A corona discharge treating apparatus equipped with a suspending electrode formed by several conductive and flexible pieces was constructed. This apparatus is good for uniformly treating awkwardly shaped objects. Either low-pressure plasma of O_2-containing gas or air corona discharge treatment can provide increased adhesion of top coatings to polypropylene-containing substrates. Air corona discharge treatment is, however, superior to low-pressure O_2 plasma.

X-ray photoelectron spectroscopy (XPS) analysis indicates that O_2-containing functionalities are responsible for enhancing the bond between the substrate and the top coating in both low-pressure O_2 plasma and air corona discharge treatment. Moreover, greater amounts of the O_2-containing functional groups were detected in air corona discharge treatment.

INTRODUCTION

Polyolefins are among the most valuable industrial plastics and are used in many different applications, mainly because of their low cost, light weight, adaptability to complicated structures, and excellent solvent resistance.[1] However, because their structure is highly crystalline and their surface polarity is low, there are serious problems of adhesion of coatings, adhesives, or printings to polyolefins. Therefore, it is important to change their surface properties in order to improve adhesion.

There are several different forms of polyolefin surface treatment, such as chromate solution, flame, solvent (vapor), low-pressure plasma, corona discharge, and ultraviolet treatment.[2,3] For example, it is common for automobile bumpers made from polypropylene (PP)-containing plastic to be pretreated by solvent (trichloroethane) vapor, followed by a primer coating.[4] This pretreatment process, however, creates considerable problems, since recent environmental protection laws and public demands for the improvement of the production process must now be taken into consideration.

A wet process, such as chromate treatment, still causes environmental problems because of the wastes that contain aqueous chromates. Among dry processes, both flame treatment and ultraviolet treatment will have difficulty uniformly treating awkwardly shaped objects. Therefore, low-pressure plasma treatment and corona treatment, both dry processes, have recently been attracting more attention and are the subjects of several investigations.

Low-pressure plasma treatment has been introduced for the practical pretreatment of automobile bumpers.[5] Corona treatment, however, is still under study. The differences between the conventional solvent vapor pretreatment and low-pressure plasma or corona treatment, are shown schematically in *Figure* 1. Specific advantages of the low-pressure plasma and corona treatments are listed in *Table* 1.

EXPERIMENTAL

Plasma Surface Treating Apparatus

The three different types of treating apparatus used are the low-pressure plasma treating apparatus (Type PD-2 by SAMCO Co., Ltd.) and two corona discharge treating apparatus developed in our laboratory. Diagrams of these three apparatus are shown in *Figures* 2 and 3.

The low pressure plasma treating apparatus has a bell jar containing two electrodes. The upper electrode is

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Presented at the Gordon Research Conferences, Plymouth State College, Plymouth, NH, Aug. 4, 1987.

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connected to an RF generator and the lower electrode is grounded. An RF wave of 13.56 MHz from the generator travels through the impedance matching network to the upper electrode. The object to be coated is set on the lower electrode. A high frequency of 13.56 MHz creates the plasma region between the two electrodes. A gas is emitted from a gas cylinder through the stainless tube to the upper electrode. A stream of gas blows out from the bottom of the upper electrode and hits the surface of the substrate.

The type "A" corona discharge treating apparatus is equipped with a suspended electrode formed by several conductive and flexible pieces which directly touch the surface of the object to be treated. Another corona discharge treating apparatus (type "B") has a bar-shaped electrode without any suspended pieces. The surface configuration of the base electrode of either the type A or B apparatus is matched to the inside shape of the substrate. An object mounted on the base electrode is set on the conveyor and moved back and forth. The power supply provides more than 10 KV to either the type A or B electrode, and creates a corona discharge region close to the surface of the substrate.

Materials

Polypropylene (PP) Substrate: The different types of PP substrates used in this experiment are shown in *Table* 2. Currently used as the substrate of PP bumpers in the domestic market, M4800 supplied from Mitsui Petroleum Chemical Co., Ltd. is the conventional type. The

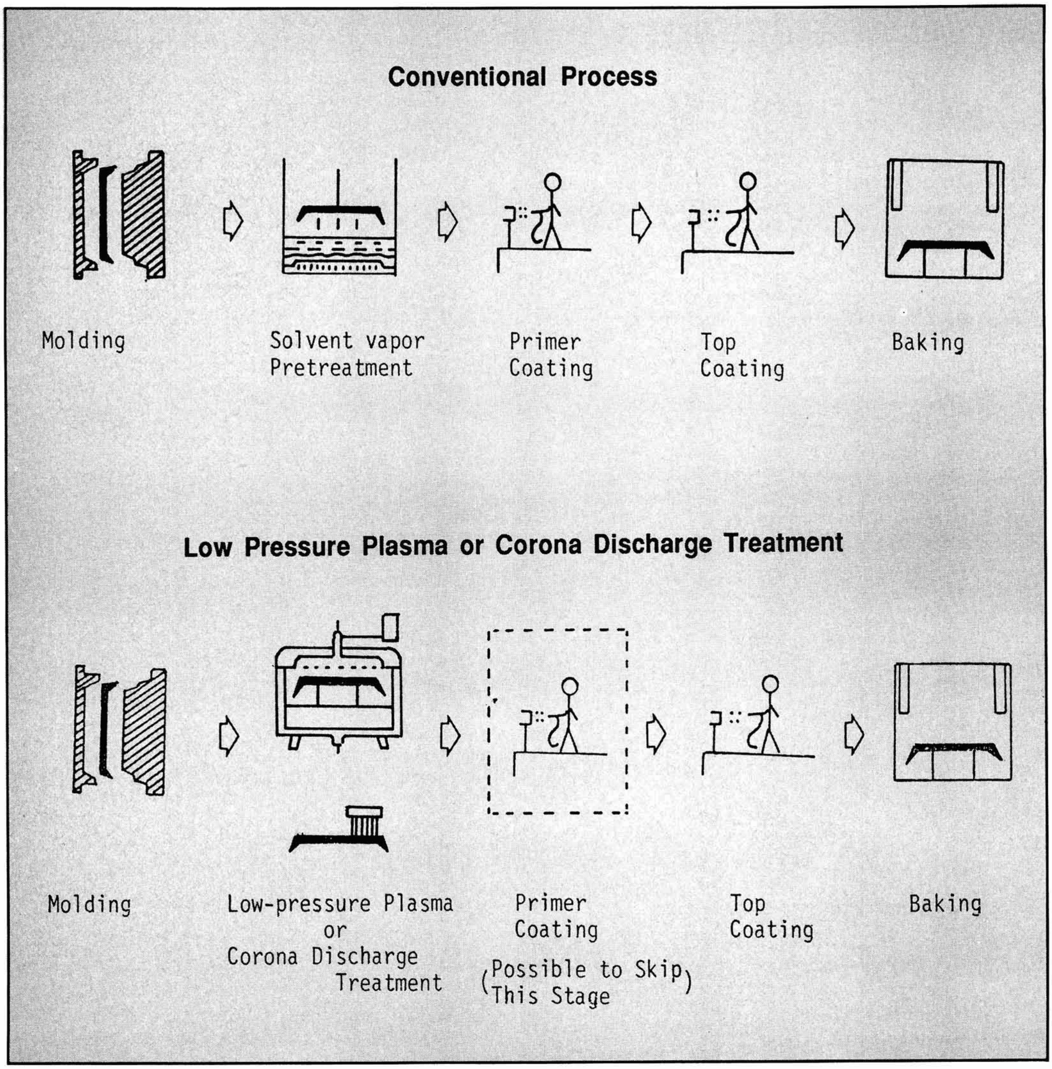

Figure 1—Pretreatment and coating process for automobile bumper

Table 1—Comparison between Practical Use Advantages Of Low-Pressure Plasma and Corona Discharge Treatment

Low-Pressure Plasma	Corona Discharge
Dry pretreatment process	Dry pretreatment process
Cost performance	Cost performance
Time saving	Time saving
Larger plasma region (good for complicated shapes)	Treatment under atmospheric condition
	Shorter treating time (higher efficiency)

melt flow rate* of M4800 is 25 g/10 min. The substrates from No. 2 to 7 are only experimentally designed and differ in ethylene-propylene rubber (EPR) content. Polypropylene-polyethylene (PP-PE) block copolymer used for substrates No. 2-7 contains 50% ethylene. The melt flow rate of this block copolymer is 15 g/10 min and its limiting viscosity number in tetralin solution is 6 dℓ/g at 135°C. EPR contains 60% ethylene and its Mooney viscosity number is ML 40 at 100°C.

COATING: The top coating used for this experiment is a two-packed urethane coating, R-271, supplied by Nippon Bee Chemical Co., Ltd.

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*Melt flow rate is measured according to ASTM D 1238.

Table 2—Different Types of Polymers Containing Polypropylene

No.	Substrate	Content of EPR	Type of Copolymer
1	M-4800[a]	40%	Block copolymer
2	PP-PE	0%	Block copolymer
3	PP-PE	5%	Block copolymer
4	PP-PE	10%	Block copolymer
5	PP-PE	20%	Block copolymer
6	PP-PE	30%	Block copolymer
7	PP-PE	40%	Block copolymer

(a) M-4800 is used for commercial automobile bumpers; substrates used in no. 2-7 were specially made for these experiments.

Characterization of Plasma Treated Surface of Substrate

X-ray photoelectron spectroscopy (XPS) analysis, surface energy measurement, and scanning electron microscope observations were all carried out on the plasma treated surfaces.

XPS ANALYSIS: XPS analysis[6] is used to detect the elements and the chemical groups introduced onto the surface by plasma treatment since plasma modification is limited to the thin surface layer (around several 10s-100sÅ). The type of XPS instrument used is Shimazu-Dupont 650-B.

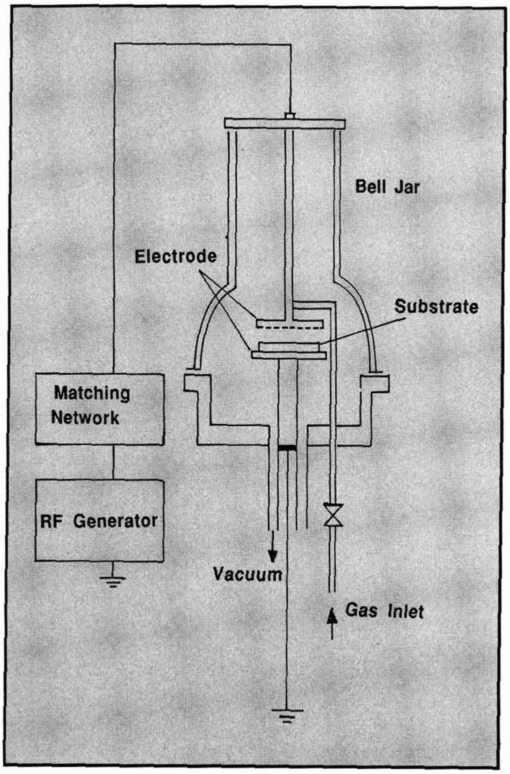

Figure 2—Schematic diagram of low-pressure plasma treating apparatus

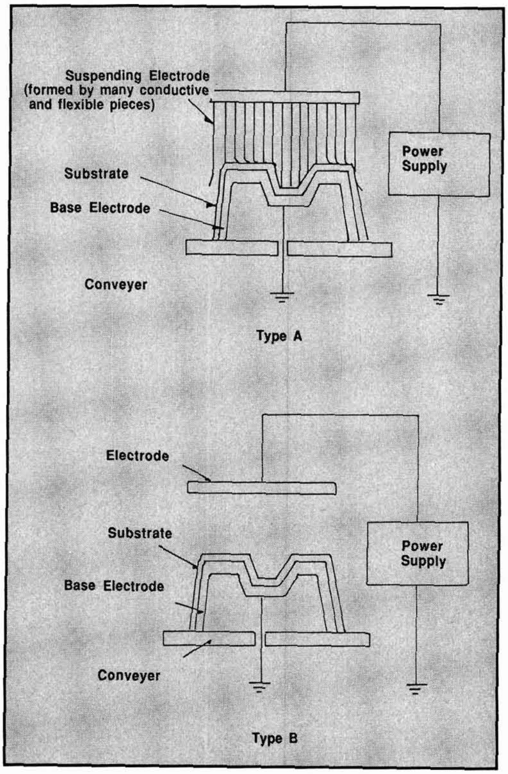

Figure 3—Schematic diagrams of two different types of corona discharge treating apparatus

Table 3—Peel Strength Obtained by Either Type A or B Corona Treatment for Different Parts of an Object

Parts	Type A (g/cm)	Type B (g/cm)
A	930 ± 50	400 ± 100
B	1050 ± 50	800 ± 100
C	1050 ± 50	400 ± 100
D	1300 ± 50	800 ± 100

Surface Energy Measurement: The surface energy of a substrate can be calculated from the contact angle measurement of a liquid droplet lying on the surface of the substrate.[7] Kyowa contact angle meter, CA-D, was used for contact angle measurement. The dispersion and polar components of surface energy are calculated through Wu's equation[8] by measuring the contact angles of water and diiodomethane on the surface of substrate, respectively: γ_L^d and γ_L^p of water and diiodomethane are known.

Wu's equation indicates that:

$$\gamma_L (1 + \mathrm{COS}\ \theta) = \frac{4\gamma_S^d\ \gamma_L^d}{\gamma_S^d\ \gamma_L^d} + \frac{4\gamma_S^p\ \gamma_L^p}{\gamma_S^p\ \gamma_L^p}$$

$$\begin{pmatrix} \gamma_L = \gamma_L^d + \gamma_L^p \\ \gamma_S = \gamma_S^d + \gamma_S^p \end{pmatrix}$$

where:

θ = Contact angle of liquid on the solid surface
γ_L = Surface energy of liquid
γ_S = Surface energy of solid
γ^d = Dispersion component of surface energy
γ^p = Polar component of surface energy.

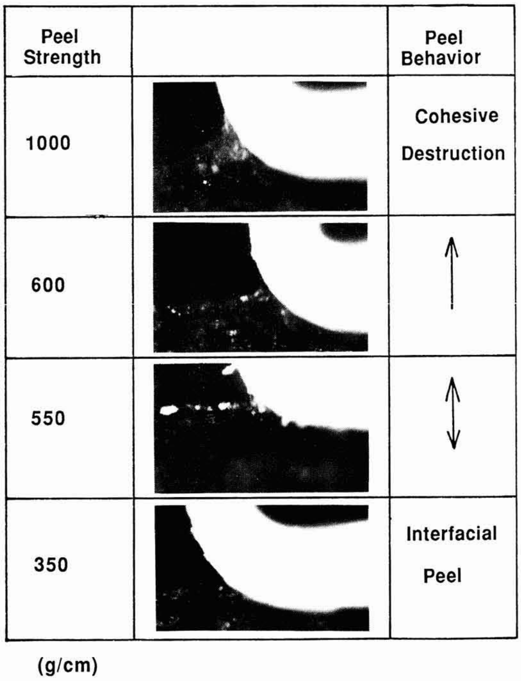

Figure 4—Photomicrograph observation of peel behavior relative to peel strength

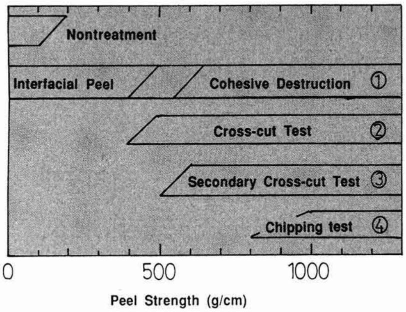

Figure 5—Relation between peel strength and practical properties: 1—results from photomicrograph observation; 2—Scotch tape test on 1 mm sq cross-cut portion; 3—cross-cut test after immersion in water of 50°C for 10 days; and 4—5 Kg/cm at −30°C.

Surface Observation: A scanning electron micrograph (SEM) was used to monitor the change in surface profile caused by plasma treatment. (Type ISI-DS130 SEM by Akashi Manufacturing Co., Ltd.).

Peel Strength Measurement: Bonding strength between the substrate and the coating is expressed in terms of "peel strength." This peel strength is measured by 180° peel of the coating (cut 5 mm wide) from the substrate using Tensilon, Type AR-6000-UAD by Toyo Bouldwing Co., Ltd., at a tensile speed of 50 mm/min, and temperature and humidity at 20°C and 75% RH, respectively. As shown in *Figure* 4, there is a strong relationship between the peel strength and two separate types of destruction known as "interfacial" and "cohesive." Complete interfacial destruction dominates up to 350 g/cm in peel strength, followed by both interfacial and cohesive destruction in the substrate (up to 550 g/cm) with destruction in the substrate ultimately playing a main role (above 600 g/cm).

Bonding between substrate and coating must be strong enough to fill the practical requirements. These relations between peel strength and practical properties are also shown in *Figure* 5.

RESULTS AND DISCUSSION

Comparison of Treating Effect of Types A and B Corona Discharge Treating Apparatus

Model objects having the shape indicated in *Figure* 6 are treated by either type A or B corona discharge treating apparatus, respectively. Results are shown in *Table* 3. The type A apparatus has a significant advantage over type B in uniformly treating the surface of an object. This is because suspended conductive and flexible pieces of the type A electrode touch every surface of an object and follow its contour, providing uniform treatment. Therefore, the type A apparatus is used for the following experiments.

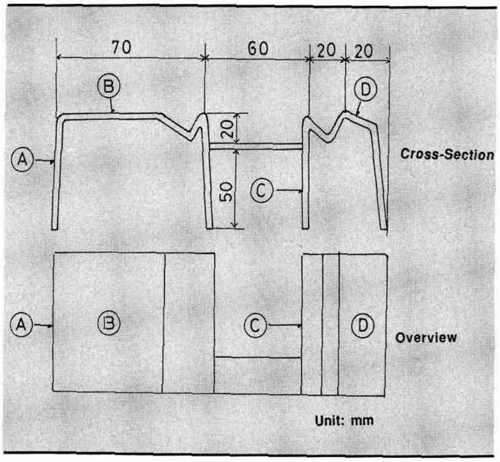

Figure 6—Dimensions of a model object

Treating Effect of Different Types Of Low Pressure Gas Plasma

The effects of different types of gas plasma on the peel strength are examined against the treating time. Peel strength measurements are carried out on conventional top coatings without a primer coating. These top coatings are directly applied on the plasma treated substrate. Results are shown in *Figure* 7. It is clear that O_2 gas is effective in increasing the peel strength. Solvent vapor pretreatment followed by a top coating, however, does not increase in adhesion.

To clarify why plasma treatment enhances peel strength, the physical condition of the surface is examined by SEM observation. These SEM pictures are shown in *Figure* 8. The nontreated surface shows a fairly smooth contour, while the surface pretreated with solvent vapor is rough with bumps and small holes. However, the surface treated by low-pressure gas plasma is a little bit rougher than that of nontreatment, but not as rough as that of solvent-vapor treatment. These results indicate that the surface roughness or etching effect is not the main cause behind increased adhesion to the top coating.

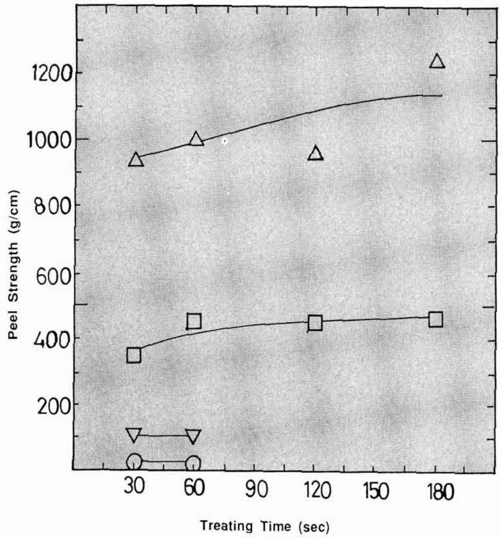

Figure 7—Differences in peel strength relative to different types of gas plasma vs treating time. Δ—low-pressure O_2 plasma treatment; □—low-pressure air plasma treatment; ∇—low-pressure N_2 plasma treatment; and ○—trichloroethane vapor treatment

Table 4—Surface Energies for Polymer Surfaces Treated by Different Types of Gas Plasma

	Surface Energy (dyn/cm) γ_s	Polar Component (dyn/cm) γ_s^P	Dispersion Component (dyn/cm) γ_s^d	Polarity (γ_s^P/γ_s)
Nontreatment	28.65	5.25	23.40	0.18
Low-pressure O_2 plasma	41.46	18.32	23.13	0.44
Low-pressure air plasma[a]	40.59	14.63	25.96	0.36

(a) 30 sec treatment.

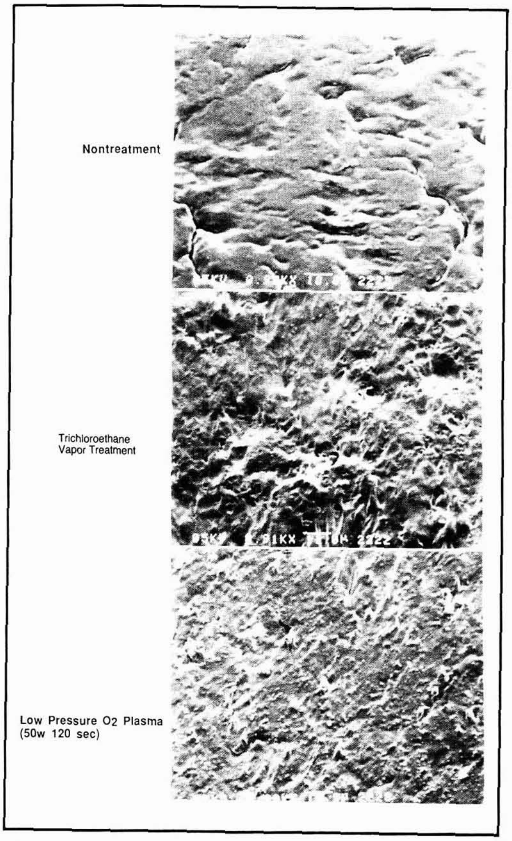

Figure 8—Electron micrograph observation of surfaces treated under different treating conditions

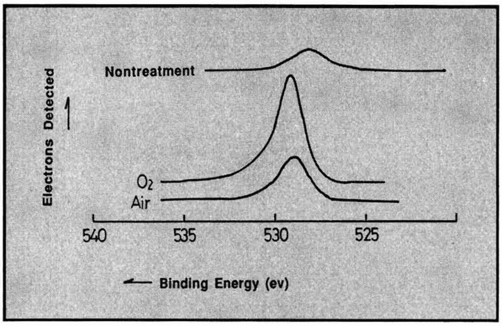

Figure 9—O_{1S} spectra for surfaces treated by different types of gas plasma

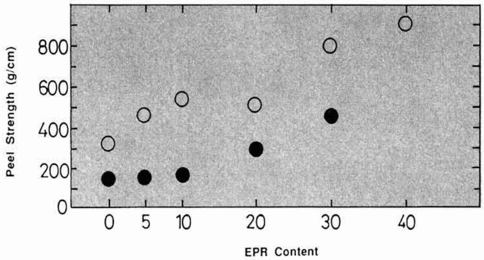

Figure 11—Peel strength relative to different treating time of O_2 plasma as a function of EPR content. ○—low-pressure O_2 plasma treatment, 60 sec; ●—30 sec

The surface energies of these substrates are listed in *Table* 4. O_2 and air plasmas show a rise in the total surface energy and its polar components. O_2 plasma contributes a greater increase in the polar component than air plasma, which suggests that O_2 plasma is more effective in increasing the polarity of the surface. Moreover, O_2 spectra of XPS in *Figure* 9 shows a dramatic increase in O_2-containing functional groups for O_2 plasma. This indicates that the increase in the polarity of the O_2 plasma treated surface is due to the increase in O_2-containing functional groups.

These facts suggest that the O_2-containing functional groups enhance both the polar component of surface energy and the bond between the substrate and coating. However, the surface roughness remains largely unaffected.

Influence of the EPR Contents On O_2 Plasma Treatment

The substrates used (No. 2-7) are PP-PE block copolymers mixed with different levels of EPR. These substrates are treated by the same condition as O_2 plasma treatment. Results are shown in *Figures* 10 and 11.

Polar components of surface energy do not change much with changes in EPR contents (within experimental errors). However, peel strength drastically increases from 300 g/cm to around 1000 g/cm as shown in *Figure* 11. One possible explanation is that EPR allows for the deeper penetration of active O_2 species from the surface to the inside, resulting in a deeper penetration of liquid paint through the activated channels, and an enhancement of bonding.

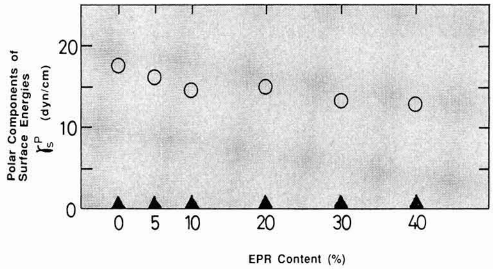

Figure 10—Polar components of surface energies for O_2 plasma and nontreated surfaces as a function of EPR content. ○—low-pressure O_2 plasma treatment, 60 sec; ▲—nontreatment

Comparison between Corona Discharge And Low-Pressure Plasma Treatment

Air corona treatment (the type A apparatus) is compared with low-pressure O_2, air, and N_2 plasma treatment in terms of peel strength. Results are shown in *Figure* 12.

The peel strength from corona discharge treatment greatly increases within a very short treating time, such as 1000 g/cm within 5 sec treatment, while low-pressure O_2 plasma cannot be expected to give more than 1000 g/cm peel strength even after a 120 sec treatment.

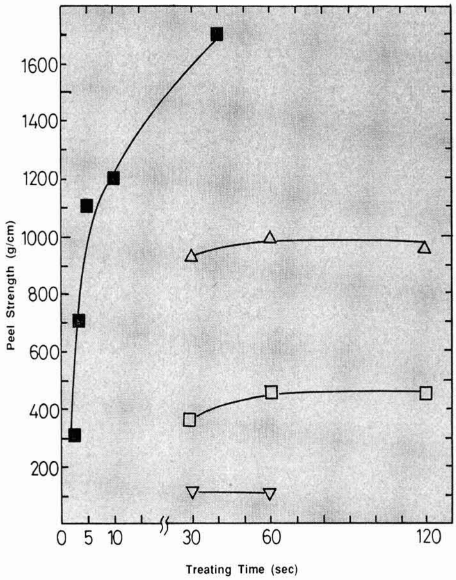

Figure 12—Comparison in peel strength between corona discharge and low pressure gas plasma as a function of treating time. ■—air-corona treatment; Δ—low-pressure O_2 plasma treatment; □—low-pressure air plasma treatment; and ∇—low-pressure N_2 plasma treatment

Table 5—Comparison in Peak Ratio of C_{1S} Spectra for Corona Discharge, Low-Pressure Plasma, and Nontreatment

	Nontreatment	Low-Pressure O_2 Plasma Treatment (30 sec)	Air-Corona Treatment (5 sec)
O_{1S}/C_{1S}	$3.2 * 10^{-2}$	$11.8 * 10^{-2}$	$17.2 * 10^{-2}$
N_{1S}/C_{1S}	—	$2.4 * 10^{-2}$	$1.8 * 10^{-2}$

The XPS analyses are carried out in order to clarify the reason for this increase in peel strength in the case of corona discharge treatment. The XPS curves are shown in *Figure* 13.

Both of the low-pressure O_2 plasma and corona discharge treatments give a similar wave form, containing hydroxyl, carbonyl, and carboxyl bonds, while nontreatment contains only a hydroxyl bond.[9] Peak ratios of O_{1S}/C_{1S} and N_{1S}/C_{1S} for three different cases are listed in *Table* 5. Corona discharge treatment provides more oxygen-containing groups than low-pressure O_2 plasma. The amount of nitrogen-containing groups, however, differs very little between the two treatments.

These results suggest that greater amounts of active oxygen exist in the vicinity of the surface of substrate during corona discharge. It is clear that the corona discharge treatment has a significant advantage in its treating efficiency.

Limitations of Corona Discharge Treatment

The change in peel strength is measured as a function of the distance from the edge of the contact piece. This procedure is shown in the experimental set-up of *Figure* 14. Results obtained are shown in *Figure* 15.

Peel strength is seen to depend on the distance from the edge of the contact piece for two different applied voltages. This indicates that the plasma region of the

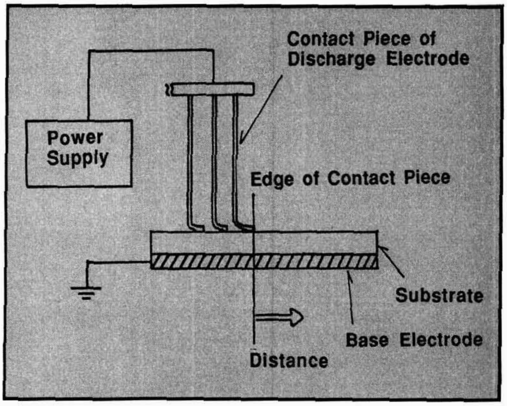

Figure 14—Experimental set up for corona treatment of surface separated from edge of contact piece of discharge electrode

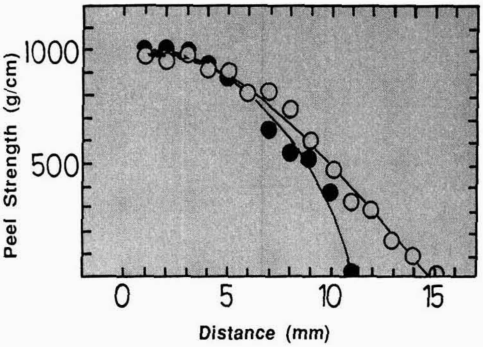

Figure 15—Peel strength for two different applied voltages as a function of distance from edge of contact piece of discharge electrode. ○—applied voltage of 24 KV · 5 sec; ●—applied voltage of 14 KV · 5 sec

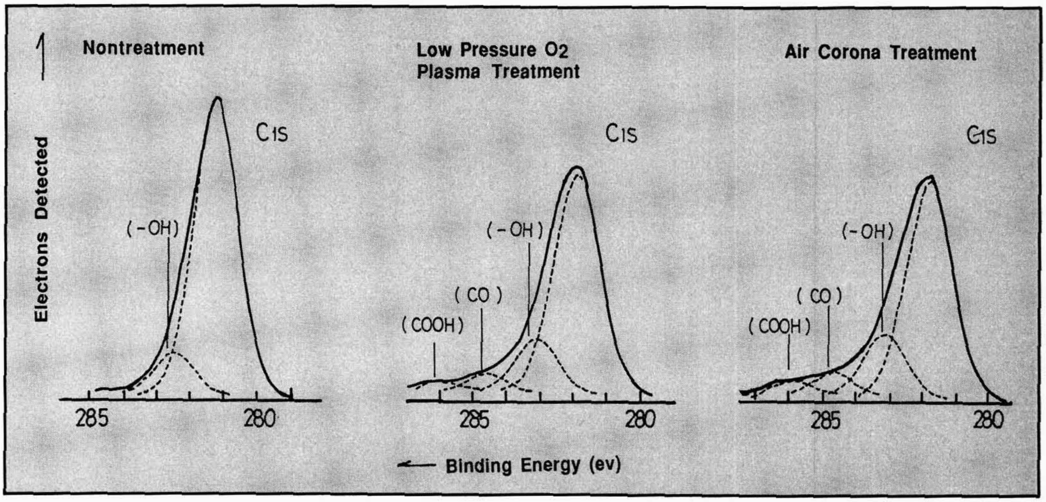

Figure 13—Wave form analysis of C_{1S} spectra for corona discharge, low-pressure plasma, and nontreatment, and their estimated assignments

corona discharge is strictly limited to the vicinity of the discharge electrode. Therefore, special consideration must be made in the construction of a practical apparatus, especially if it is to be used for the treatment of awkwardly shaped objects.

CONCLUSION

A corona discharge treating apparatus equipped with a suspending electrode formed by several conductive and flexible pieces was constructed. The advantage of this apparatus is its uniform treatment of complicated shaped objects, due to the flexible pieces of electrode that can touch every surface of an object.

Either low pressure plasma of O_2-containing gas or air corona discharge treatment can provide the increase in the adhesion of top coatings to polypropylene substrate, which allows for a simpler coating process than the conventional process. Air corona discharge treatment is, moreover, superior to low-pressure O_2 plasma in peel strength and treating time.

The ethylene-propylene rubber (EPR) content of polypropylene substrate also contributes to stronger bonding, and the higher EPR content provides higher bonding strength. One possible explanation is that EPR might allow deeper penetration of active O_2 species from the surface to the inside, causing deeper penetration of liquid paint through the activated channels, resulting ultimately in enhanced bond strength.

XPS experiments reveal that O_2-containing functionalities are responsible for enhancing both the polar component of the surface energy and the bonding between the substrate and the top coating in both low-pressure O_2 plasma and air corona discharge treatment. Higher contents of the O_2-containing functional groups were detected in air corona discharge treatment. This fact indicates that greater amounts of active oxygen exist in the vicinity of the substrate's surface during corona discharge. Corona discharge is, however, limited in its effective discharge region. This limitation makes it necessary to study further the construction of a practical apparatus.

References

(1) Shimizu, S., *Plastic Age, 34,* 146 (1988).
(2) Greene, R.S., *Tappi, 48,* No. 9, 80 (1965).
(3) Broadley, A. and Fales, I.D., *Chem. Tech.,* April, 232 (1971).
(4) Suzuki, H., Ikeda, T., Tange, K., and Wuotani, K., *J. Soc. Auto. Eng. Japan, 38,* 953 (1984).
(5) Fukuda, K., Takahashi, Y., and Kaneko, T., *Toyota Engineering, 35,* 24 (1985).
(6) Sobugawa, T., Endo, K., and Sugiyama, O., Report of the Shizuoka Prefectural Industrial Technical Center, No. 30, 27 (1986).
(7) Hata, T., *Kobunshi, 32,* 648 (1983).
(8) Wu, S., *J. Phys. Chem.,* C43, 19 (1971); *J. Adhesion, 5,* 39 (1970).
(9) Clark, D.T. and Dilks, A., *J. Polymer Sci., Polymer Chem. Ed., 17,* 957 (1979).

New Horizons in Coatings Science And Technology

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The art of making paint, which was the pioneer polymer technology, continues to be an important facet of polymer technology and is becoming more scientific. In spite of the development of many new surfaces that do not require protective or cosmetic coatings, the annual sales of paint in the U.S. is in excess of $10 billion. The volume of low-solids coatings continues to decrease, but this decrease is counteracted by an increase in the volume of water-borne and higher-solids coatings.

In spite of many new stringent regulations by EPA and related agencies, the paint industry has been able to produce modern compliance coatings. New tests that are now available enhance quality improvement and the technical stature of the paint industry. The many acquisitions of smaller firms by the leading paint producers and the establishment of new production facilities is indicative of the industry's progress. The large number of articles referred to in this review is also indicative of the vigorous activity of paint technologists in improving the stature of the paint industry.

HISTORY

The art of making paint, which was practiced over 25,000 years ago, followed by the discovery of oleoresinous coatings 2,000 years ago, ranks along with the tanning of leather and the invention of the wheel as a major advance in world history. Fortunately, the art of making paint has been transformed into a science and advances in this important branch of polymer science continue to occur.[1]

The coatings industry, like many other branches of polymer science, has lagged behind the entertainment and sports world in recognizing those who have been responsible for some of the progress in this field. However, the relatively new Roy W. Tess Award has recognized the contributions of W.D. Emmons (1985), M. Wismer (1987), Z. Wicks (1988), and T. Provder (1989).

In addition to occasional coatings-oriented symposia, sponsored by the Polymer Materials Science and Engineering Division, formerly the Paint and Varnish Division of the American Chemical Society (ACS), advances in coatings science and technology have been featured at the FSCT Annual Meeting and Paint Show, attended by over 8,000 delegates at Chicago in 1988;[2] at the 17th Annual Higher-Solids and Water-Borne Coatings Symposium, attended by over 500 delegates at New Orleans in 1989;[3] at the IUPAC meeting in Jerusalem;[4] and at the 15th International Conference on Organic Coatings in Athens, attended by over 100 delegates.

An article on coatings in a new encyclopedia[5] and new information on the history of amino coatings[6] and other organic coatings[7] were published. The original paint dictionary, published in the 1940s,[8] has been updated and enlarged to over 4,500 definitions. A symposium, on the ''History of Coatings,'' will be sponsored by the History of Chemistry Division of the ACS at its National Meeting in Miami Beach, FL, in September 1989. The proceedings of this symposium will be published.[9]

It is of interest to note that Larry L. Thomas, who was President of the National Paint and Coatings Association (NPCA), has accepted a comparable position with the Society of the Plastics Industry, which plans to move its headquarters from New York to Washington, D.C.

PAINT SALES

Record demand in 1987 resulted in the American paint and coatings industry's best year. Over one billion gallons of paint, with a value of over $10 billion, was sold in the U.S. in 1987.[10] In spite of a lack of emphasis on paint by the chemical industry, there is scarcely a single U.S.

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chemical company that does not number at least one paint company among its customers. The paint market is the world's major consumer of polymers.[11]

Sherwin-Williams, with annual paint sales of $1.9 billion, continues to lead other American paint producers in sales.[12] The other principal producers are Valspar, Grow, Standard Brands, RPM, DeSoto, Lilly Industrial Products and Guardsman Products.[13] According to Rauch Associates, the dollar value in millions of dollars and the volume of paint in millions of gallons produced in the U.S. in 1987 were as follows[14]:

	Sales million $	Sales million gallons
Architectural coatings	4,250	521
Product (original equipment, OEM)	3,845	362
Special purpose coatings	1,955	138
TOTAL	10,050	1,021

The breakdown in percent in 1986 and estimated breakdown for 1996, in accordance with formulation, is as follows:

	1986	1996
Low-solids coatings	51	35
Two-component coatings	16	19
Higher-solids coatings	6	9
Latices	8	10
Water-soluble coatings	13	18
Powder coatings	4	6
Radiation cured coatings	1	3

According to Chemark of Cincinnati, the growth rate of water-based coatings is twice that of general purpose paints. The dollar value and volume of water-borne paints produced in the U.S. in 1987 was $500 million and 100 million gallons, respectively. The percent product mix was acrylics (33%), vinyls (20%), and epoxies (20%).

The dollar value and volume of powder coatings produced in 1987 was $28 million and 82 million pounds.[15] The clear topcoat of paint on the Ford LTD Crown Victoria and the Mercury Grand Marquis was applied as a powder coating.

According to *Polymer News*, 1.1 billion pounds of hot melt coatings at a cost of $840 million was consumed in the U.S. in 1987 and this volume should increase to 1.35 billion pounds in 1991.[16] According to *Adhesives Age*, the value of hot melt coatings produced in 1987 was $799 million and the amount to be produced in 1992 is 927 million pounds. The product mix, in millions of pounds, is, as follows[17]:

Ethylene-vinyl acetate copolymers (EVA)	131
Polyethylene (LDPE, HDPE)	121
Atactic (amorphous) polypropylene	59
Styrene-butadiene block copolymers (SBS)	39
Polyamides (PA)	17
Polyesters (PE)	14

Developments in water-borne coatings for flexible packaging have been reviewed.[18] The annual production in square yards of vinyl coated roll goods and wall coverings is 130 million and 548 million, respectively.[19] Over $100 million worth of thin coatings are used annually for protecting printed circuitry.[20]

ACQUISITIONS

ICI, with worldwide paint sales of $2 billion in 1987, has purchased BJN Australia which includes Berger Paints and Sileys Chemical. ICI, which is the largest global paint firm, has also acquired Sherwin-Williams' Canadian Paint Business, and has joined with Du Pont to supply automotive coatings in Europe and with Nippon Oil and Fats to exchange technology on coatings for OEM.[21]

Du Pont, which acquired Ford's North American paint operation[22] in 1986, has also acquired the Duco Auto Paint Business from Caso-Nobel in France.

PPG continues as the leading producer of paint for OEM and is followed by BASF, Konsai, Nippon, Du Pont, Hoechst, and ICI. Glidden, which was acquired by ICI, is not a mainstream supplier of paint for OEM.

PPG coatings are used on U.S. Toyotas at Georgetown, KY, as well as on Honda, Mazda, and Nissan and is a major supplier for the United Motors Toyota-GM joint venture in Freemont, OH.[23] BASF plans to build a paint production facility in Indiana or Ohio.

In addition to acquiring LanChem Corp., Akzo has purchased Tints y Piranga in Brazil from Hanson Industries, Quimicas Procolor in Spain, and General Paints in Mexico. Akzo now has annual sales of $1.2 billion and has a work force of 11,500. DMS is expanding its powder coatings operations in Beijing and Taiwan.

McPherson, a subsidiary of Finland's Kemira, has acquired Valspar Paints in the U.S. and Alexander-Ferguson Co., in Scotland. Kemira plans to expand its titanium-dioxide production capacity at Savannah, GA, to 145,000 tons.

SOLVENT-BORNE COATINGS SYSTEMS

Because of the tightening of restrictions on volatile organic content (VOC), many new innovations have been made on solvents,[24] including: the use of naphthas,[25] solvent recovery,[26] cosolvents in water thinnable stoving paints,[27] cost effective solvents,[28] computer assisted solvent selection (CASS),[29,30] precautions for health and safety,[31] and advantages of chlorinated alkanes, such as 1,1,1-trichloroethane.[32] One-component polyester-acrylics are recommended for high-solids coatings.[33]

POWDER COATINGS

It was estimated that 190,000 tons of powder coatings were used in the U.S. in 1987 and that the annual growth rate in the 1990s would be 15%.[34] The development of epoxy, polyurethane, and other weather resistant powder coatings systems has been reviewed.[35,36]

MELT COATINGS

The effect of the concentration of added paraffin wax to EVA melt coatings has been investigated.[37] The advantages of bitumen-epoxy melts for coating concrete surfaces[38] and coumarone and terpene resins[39] have been discussed.

WATER-BASED COATINGS

Crosslinkable, surfactant-free ethylene-vinyl chloride copolymer emulsion systems are available.[40] New information is available on water soluble air-dry alkyds,[41] the wet hiding power of latex paints,[42] water thinnable saponification-resistant resin systems,[43] immersion film water-borne coatings systems,[44] effect of isoparaffins on surface tension and pigment wettability,[45] mechanisms of thickening of latex systems,[46] and application requirements for interior[47] and exterior latex paints.[48] Ionomer coatings have been produced from water soluble carboxylated polymers.[49] Styrene-maleic anhydride copolymers have been proposed for use as dispersion water-borne coatings[50] and the advantages of water-borne paint systems have been discussed.[51]

SURFACE PREPARATION

New information is available on filling, sanding, and smoothing techniques for automotive refinishing.[52] A new nonsolvent method for stripping paint using recoverable plastic beads is being investigated at Battelle Institute.

OLEORESINOUS PAINTS

New information on the use of linseed oil in paint production has been published.[53] New information is also available on the history of the production of oleochemicals by saponification of oils,[54] on the use of rapeseed and sunflower oils in paints,[55] and the potential use of other vegetable oils, such as *Jatropha pandureafolia, Jatropha podagarica, Phyllanthus maderaspateusis, Croton sparciflorus, Heynea trijuga,* and *Millingtonia hortensis.*[56] The oil from seeds of *Diployclclos palmatus,*[57] the relationship of composition of vegetable oils and thermoxidation volatile components,[58] convolvolacea and leguminosae seeds,[59] and calendula and coriandrum[60] have been investigated. GPC, carbon-13 NMR, and proton NMR have been used to monitor the autooxidation of linolenates in the presence of driers.[61]

CURING OF PAINTS

Lead and cobalt salts of unsaturated vegetable oils[62] and strontium desiccants have been used as driers or autooxidation catalysts. Unsaturated prepolymers have been cured rapidly by ultraviolet radiation[62–64] and by visible light.[65] The chemistry and physics[66] and kinetics[67] of crosslinking have been investigated. Interpenetrating polymer networks (IPN) have been produced from castor oil-based polyurethanes and polyacrylates.[68] Compatible IPNs have a single glass transition temperature (T_g) while those that are incompatible have more than one T_g.[69]

POLYESTER COATINGS

Alkyds, like oleoresinous paints, are also polyesters. Alkyds have been modified by grafting with styrene and p-methylstyrene[70] and by grafting liquid crystalline segments, such as p-hydroxybenzoic acid to the main polymer chain.[71] The problem of cathodic blistering is greater for lead oxide alkyds than for zinc chromate alkyds.[72]

Acrylics are also polyesters but the esters are on pendant groups rather than in the principal polymer chain. New developments in acrylics include: an investigation of two-component acrylic-urethane coatings,[73] grafting of acrylics onto PVC via benzodithiolate groups,[74] cyanoacrylates,[75] and solid acrylic resins.[76] 2,3-Epoxypropyl esters were prepared from 1-chloro-2,3-epoxypropane.[77] Unsaturated polyester resins which cure in the presence of oxygen have been produced from polyallyl glycidyl ether.[78]

EPOXY RESINS

The curing of epoxy resins has been monitored by differential scanning calorimetry[79] and by UV/visible and fluorescence spectroscopy.[80] New reports on epoxy resins include new smooth surface forming powder coatings,[81] copper coatings,[82] high-solids epoxy resins,[83] and flexible epoxy coatings.[84,85] The production of resins from bisphenol A has been discussed.[86]

POLYURETHANES

Urethane oligomers,[87] two-package polyurethane coatings,[88] polyurethane anionomers,[89] and aqueous dispersions of polyurethanes[90] have been described. A simple sinking pool model has been used for modelling premature phase separations during polyol block copolymerization of urethanes.[91]

MISCELLANEOUS COATINGS RESINS

The use of coatings based on styrene/acrylic emulsion,[92] the history of styrene copolymers,[93] and the use of styrene block copolymers as hot melts[94] have been described. The life of frozen meats has been extended by the application of edible coatings based on seaweed.[95] Barrier films have been obtained by coating organic polymers with thin layers of glass.[96] The rate of denitration of cellulose nitrate coatings has been retarded by the addition of ferrous ions.[97]

APPLICATION OF COATINGS

Paints filled with carbon[98] and aluminum flakes[99] are being used for shielding from electromagnetic interference. Carbon black-filled coatings have also been electrocoated.[100] New available information includes corrosion resistant coatings,[101] coatings performance in gaseous atmospheres,[102] the reduction of attack by corrosives in the presence of zirco-aluminates,[103] the performance of coatings in gaseous atmospheres,[104] and the application of roof coatings.[105]

New information is available on silicone release coatings[106,107] and zinc-rich coatings.[108–110] Du Pont has guaranteed the paint on the 11,268 ft Newport Bridge across Naragansett Bay for 10 years.[111] Electrophoretic coatings are being used for cathodic deposition.[112] New data are also available on the effect of temperature and concentration on solutions of polyvinyl acetate.[113] The effect of thickeners, temperature, and solvent concentration on the drying rate of coatings,[114] and information on deposited films[115] and film forming resins[116] are available.

PIGMENTS AND FILLERS

The effects of different types of silica fillers[117] and sources of kaolin[118] have been reported. Other reports have been issued on the optimum particle size,[119] developments in pigment processing,[120] and plasma treatment or organic pigments.[121] The effect of length of pendant groups in acrylic resins on the dispersibility of ferric oxide[122] and the covering power of pigments[123] have been investigated. Other reports include the effect of binders on pigment flocculation,[124] the production of submicron particles,[125] computer controlled dispersion of pigments,[126] the effect of modifications of pigments on their dispersibility,[127] and the application of pearlescent pigments.[128]

New information has been published on the history and toxicity of lead chromate,[129] on the partial replacement of titanium dioxide by alumina trihydrate,[130] and temperature resistant colorants.[131] Engelhard is spending $80 million to increase its production facilities for kaolin.[132]

ADDITIVES FOR COATINGS

Zirconium compounds are being used as thixotropes in coatings with carboxyl or hydroxyl groups.[133] Isothiazoline is being used as a nonmetallic fungicide.[134] Dicarboxy-bis-azomethine is being used for curing epoxy resins.[135] Acrylic nonionic surfactants are being used as thickeners.[136] It has been proposed that the quenching efficiency of hindered amine stabilizers depends on steric hindrance at the amino group of the piperidines and that the nitroxyl free radicals and hydroxylamines produced by exposure of polyolefins to light are active stabilizers.[137]

The historical development of antifouling paints has been reviewed.[138] The addition of cuprous oxide to organotin polymers improved their antifouling efficiency[139] but the use of these additives has been banned on small boats. Several mildewcides have been approved as replacements of mercury compounds for the control of Cladosporium.[140] Fungicidal coatings have been reviewed.[141]

TESTS FOR COATINGS

Crosslinking has been characterized by monitoring the solvent evaporation rate.[142] A free volume microprobe has been used to monitor pigment dispersion.[143] Tests have been devised to prevent the development of defects in appliance coatings.[144] Laser-microscopic and mass spectroscopy tests (LAMMS) have been used to detect such defects.[145] Fluorescent microscopy has been used to monitor solvent retention in sheet molded composites.[146] Tests have been developed to measure the relationship between T_g, crosslinking, gel content, and performance of acrylic microgels.[147]

Tests have shown that acrylic coatings containing water repellants and mildewcides have good weather resistance.[148] New information is available on weathering tests of architectural coatings,[149] on the efficiency of bactericides and fungicides,[150] and the analysis of latex systems.[151]

A Larau Viscometer has been used for measuring the viscosity of paints.[152] Shear thinning indices determined by a Brookfield viscometer and yield point predictions from a Caisson-Bingham plot have been used to predict resistance to sagging of thixotropic epoxy coatings systems.[153] High shear rheometry and electrophoretic mobility have been used to monitor mechanical stability of water-borne coatings.[154,155]

Flocculation gradient techniques have been used to measure the extent of dispersion of pigments in paint systems.[156] The rate of corrosion of coated steel has been monitored by electrical resistance and other measurements.[157-159] Dynamic mechanical and thermogravimetric analysis have been used for quality control of magnetic coatings.[160]

Predictive tests are useful in the evaluation of drying rates of solvent-borne coatings.[161] Thermal desorption and capillary column GC have been used to determine the solvent composition in automotive paints.[162] Electrochemical impedance spectroscopy has been used to evaluate corrosion behavior of internally coated metal containers.[163]

The critical coagulation concentration of latex coatings is related to the concentration of multivalent ions from zinc oxide or calcium carbonate fillers.[164] Other tests for water-borne coatings[165] and for paints[166] and functional group analysis[167] have been discussed. Absorbance of acrylic groups at 810 cm^{-1} has been used to monitor the effect of UV on coatings.[168]

COMPLIANCE COATINGS

New EPA studies may lead to additional restrictions in the use of cadmium and lead pigments and stabilizers.[169] Present enforcement of the Clean Air Act has catalyzed an increase in use of high-solids, powder, and UV-cured coatings.[170] Over 350 alleged violations have been investigated by EPA, but the NPCA has questioned the reliability of some of EPA's tests.[171]

As pointed out in a comprehensive review in *Chemical Week*,[172] compliance trends that originate in California spread quickly across the nation. The South Coast Air Quality Management District (SCAQMD) has suggested an "emission charge" based on VOC content. The present VOC limit for nonflat architectural paints is 250 g/L but that for lacquers is 680 g/L.

SCAQMD is attempting to reduce VOC from the present 22 tons/day in the Los Angeles basin area to 2 tons/day by 1996. As might be expected, imported automobiles are coated before they arrive in the U.S. and some California manufacturers are planning to move to other areas. However, agencies in other parts of the U.S. are following SCAQMD restrictive regulations. Some California firms have increased the solids content of solvent-borne coatings and have emphasized the use of water-borne coatings. However, some paint technologists maintain that coatings formulated to comply with new regulations are far inferior to conventional paints.

Many technologists believe that it will be essential to use 1,1,1-trichloroethane to meet the VOC required by the 1990 SCAQMD standard. It is generally agreed that large R&D investments are required if a producer wishes to compete in the OEM market. Most important, as stated by S.W. Becker of the State and Territorial Air Pollution Administrators, "the responsibility for controlling VOC should be spread widely and that no one industry should be singled out."

References

(1) Seymour, R.B., "Coatings Progress in the Mid-1980's," Journal of Coatings Technology, *59,* No. 745, 49 (1987); "Recent Advances in Coatings Science Technology," Journal of Coatings Technology, *60,* No. 759, 57 (1988).
(2) Ehrle, C. and Rotman, D., *Chem. Week, 143,* No. 18, 36 (1988).
(3) Seymour, R.B., *Polymer News, 13,* 29 (1987).
(4) Seymour, R.B., *Paintindia, 37,* No. 11, 31 (1987).
(5) Seymour, R.B., "Coatings and Colorants, Encyclopedia of Physical Science and Technology," Vol. 3, Academic Press, 1987.
(6) Kirsch, A.J., *Am. Paint Coat. J., 73,* No. 34, 37 (1988).
(7) Seymour, R.B., *Paintindia, 37,* No. 8, 23 (1987).
(8) Stewart, J.R., and Seymour, R.B., "National Paint Dictionary," 3rd Ed., Stewart Research Laboratories, Washington, D.C., 1948.
(9) Seymour, R.B. (Ed.), "Organic Coatings: Their Origin and Development," Elsevier Science Press (in press, 1989).
(10) Reisch, M.C., *Chem. Eng. News, 66,* No. 37, 37 (1988).
(11) Savage, P.R., et al., *Chem. Week, 143,* No. 16, 28 (1988).
(12) Kiesche, E.S., *Chem. Week, 143,* No. 24, 40 (1988).
(13) Parkinson, G., *Chem. Week, 141,* No. 9, 12 (1988).
(14) Prane, J.W., *Polymer News, 13,* 337 (1988).
(15) Bocchi, G.J., *Am. Paint Coat. J., 72,* No. 49, 36 (1988).
(16) Kirshenbaum, G.S., *Polymer News, 13,* 381 (1988).
(17) Schlechter, M.M., *Adhesives Age, 30,* No. 12, 18 (1987).
(18) Full, J.A., *Adhesives Age, 32,* No. 2, 22 (1989).
(19) Kirshenbaum, G.S., *Polymer News, 13,* 216 (1988).
(20) Wilkinson, S.L., *Chem. Week, 143,* No. 18, 24 (1988).
(21) Short, H.C. and Ushio, S., *Chem. Week, 142,* No. 13, 10 (1988).
(22) Ehrle, C., *Chem. Week, 142,* No. 11, 24 (1988).
(23) Wilson, L.J., *Chem. Week, 143,* No. 9, 7 (1988).
(24) Leach, R., *Ink Paint, 4,* No. 4, 19 (1986).
(25) Odozi, T.I., et al., *Paint Col. J., 177,* No. 4184, 73 (1987).
(26) Reay, W., *Paint Col. J., 177,* No. 4185, 89 (1987).
(27) Stoye, D., *Coating, 20,* No. 6, 223 (1987).
(28) Sheen, A.D., *Ink Print, 5,* No. 2, 22 (1987).
(29) Anon, *Ink Print, 5,* No. 2, 24 (1987).
(30) Kalina, J., *Mod. Paint Coat., 77,* No. 14, 44 (1987).
(31) Dutta, P.K., *Paintindia, 37,* No. 11, 21 (1987).
(32) Richards, J., *Am. Paint Coat. J., 73,* No. 13, 126 (1988).
(33) Su, C-S., *Paint Coat. Ind.,* No. 3, 39 (1987).
(34) Jatia, V.K., *Paintindia, 39,* No. 12, 24 (1987).
(35) Schuler, D., *Farbe Lack., 93,* No. 4, 272 (1987).
(36) Hoppe, M., "New Developments in Weather Resistant Powder Coatings," Journal of Coatings Technology, *60,* No. 763, 53 (1988).
(37) Graves, T.R. and McCormick, J.G., *Adhesives Age, 31,* No. 7, 22 (1988).
(38) Sokalska, A., *Mater. Bud.,* No. 11/12, 18 (1986).
(39) Tirodkat, R.B. and Homaya, H.K., *Paintindia, 39,* No. 3, 13 (1988).
(40) Vijayendran, B.R., Iacoviello, J.G., and Derby, R., "Some Unique Features and Applications of Novel Ethylene-Vinyl Chloride Latex Emulsions," Journal of Coatings Technology, *61,* No. 768, 45 (1989).
(41) Echler, P.E., *Am. Paint Coat. J., 72,* No. 34, 37 (1988).
(42) Huber, W., *European Paint J.,* No. 5, 370 (1988).
(43) Blum, H., *European Paint J.,* No. 1, 8 (1989).
(44) Bean, J., *Paintindia, 37,* No. 7, 27 (1987).
(45) Storfer, S.J., DiPiazzo, J.T., and Moran, R.E., "Isoparaffins Impart Beneficial Properties to Coatings," Journal of Coatings Technology, *60,* No. 761, 37 (1988).
(46) Jansen, J.W., Blom, C., and Mellema, J., *Verfkroniek, 60,* No. 3, 94 (1987).
(47) Wahl, G.P., *Mappe., 107,* No. 6, 29 (1987).
(48) Wahl, G.P., *Deut. Materblatt, 58,* No. 7, 6814 (1987).
(49) Nicholson, J.W. and Wilson, A.D., *J. Oil Colour Chemists' Assoc., 70,* No. 7, 189 (1987).
(50) Wang, Y-R., *Paint Coat. Ind.,* No. 5, 36 (1986).
(51) Anon, *Ind. Corros., 5,* No. 4, 6 (1987).
(52) Anon, *Deut. Materblatt, 58,* No. 7, 674 (1987).
(53) Langer, G.M., *Farbe Lack., 92,* No. 12, 1221 (1986).
(54) Steinberner, U. and Preuss, W., *Fat. Sci. Tech., 89,* No. 8, 324 (1987).
(55) Marquard, R. and Rock-Okuyucu, B., *Fat. Sci. Tech., 89,* No. 8, 326 (1987).
(56) Sundarrao, K. and Lakshminarayana, B., *Fat. Sci. Tech., 89,* No. 8, 324 (1987).
(57) Patel, G.R., Patel, M.J., and Patel, R.J., *Fat. Sci. Tech., 89,* No. 8, 331 (1987).
(58) Kitturm, H., Mahajanshetti, C.S., and Lakshminarayana, G., *Fat. Sci. Tech., 89,* No. 7, 269 (1987).
(59) Melerzu-Beerentrup, H. and Robbelen, G., *Fat. Sci. Tech., 89,* No. 6, 227 (1987).
(60) Orbarganes, M.C., Rios, J.V., and Perez-Camino, M.C., *Grasas y Aceites, 37,* No. 2, 61 (1986).
(61) Eng, K., *Scand. Paint & Print Ink,* Horsholm, Denmark, 1987.
(62) Singh, P. and Kolkarni, A.S., *Paintindia, 37,* No. 12, 27 (1987).
(63) Abadie, M.J.M., *European Coat. J.,* No. 5, 350 (1987).
(64) Moreau, M., *Adhesives Age, 31,* No. 4, 20 (1988).
(65) Rogers, S.C., *Adhesives Age, 31,* No. 4, 20 (1988).
(66) Provder, T., "Cure Characterization in Product Research and Development," Journal of Coatings Technology, *61,* No. 770, 32 (1989).
(67) Olson, K.L., Wong, C.A., Fleck, L.L., and Lazar, D.F., "Qualitative and Quantitative Determination of Solvent Formulations in Automotive Paints," Journal of Coatings Technology, *60,* No. 762, 45 (1988).
(68) Patel, M. and Suthar, B.J., *Polymer Sci. Polymer Chem., 25,* 1251 (1987).
(69) Xiao, H.X. and Frisch, K.C., "Coatings Containing Interpenetrating Polymer Networks," Journal of Coatings Technology, *61,* No. 770, 51 (1989).
(70) Seymour, R.B., Storey, R.F., and Lee, O.A., *Polymer Mat. Sci. Eng., 59,* 1144 (1988).
(71) Chen, D-S. and Jones, F.N., "Binders for Higher-Solids Coatings Part III:—Model Alkyd Resins Modified by Liquid Crystalline Groups," Journal of Coatings Technology, *60,* No. 756, 39 (1988).
(72) Rodriguez, V.S. and Leidheiser, H. Jr., "Cathodic Blistering of Two Alkyd Paints," Journal of Coatings Technology, *60,* No. 757, 45 (1988).
(73) Nakamichi, T. and Ishidoya, M., "Cure Behavior and Film Properties of Two-Component Acrylic Urethane Coatings," Journal of Coatings Technology, *60,* No. 766, 33 (1988).
(74) Gressler, J.C., *J. Macromol. Sci., A23,* No. 11, 1263 (1986).
(75) Martin, F.R., "Structural Adhesives," Elsevier Science Publishers, New York, 1986.
(76) Kulh, G. and Christian, H-D., *Farbe Lack., 92,* No. 12, 1142 (1988).
(77) Soutif, J.C., Razermera, F., and Brosse, J.C., *Makromol. Chem. Makromol. Chem. Phys., 188,* No. 1, 35 (1987).
(78) Knapczyk, J.W., "Polyally Glycidyl Ether Resins for Very Fast Curing High Performance Coatings," Journal of Coatings Technology, *60,* No. 756, 63 (1988).
(79) Patel, R.D., Patel, R.G., and Patel, V.S., *Brit. Polymer J., 19,* No. 1, 37 (1987).

(80) Sung, C.S.P., Pyon, E., and Sun, H-L., *Makromol.*, *19*, No. 12, 2922 (1986).

(81) Fischer, G.C. and McKinney, L.M., "New Epoxy Resin for Ultra-Smooth Hybrid Powder Coatings," Journal of Coatings Technology, *60*, No. 762, 39 (1988).

(82) Granata, R.D., Deck, P., and Leidheiser, H. Jr., "Epoxy Powder Coatings for Conformal Coating and Corrosion Protection of Copper," Journal of Coatings Technology, *60*, No. 763, 41 (1988).

(83) Agostinho, M. and Brytus, V., "A High Solids One-Component, Low Temperature Bake Epoxy Coating," Journal of Coatings Technology, *60*, No. 764, 61 (1988).

(84) Hentschel, K.H., *European Coat. J.*, No. 3, 188 (1988).

(85) Reis, T.M., *Paintindia*, *37*, No. 9, 29 (1987).

(86) Trivedi, M.K. and Dedhia, S., *Paintindia*, *37*, No. 7 (1987).

(87) Blank, W.J., "Polyurethane Oligomers for Water-Borne and High Solids Coatings," Journal of Coatings Technology, *60*, No. 764, 43 (1988).

(88) Epple, R., *European Coat. J.*, No. 4, 366 (1987).

(89) Al-Sahah, H.A., et al., *J. Polymer Sci. Polymer Chem.*, *25*, 2127 (1987).

(90) Frieden, J., *Pinturas Acabados*, *25*, No. 156, 17 (1987).

(91) Miller, J.A., et al., *Polymer*, *20*, 758 (1987).

(92) Bourman, J.L. and Palmer, M., *Paint Resin*, *57*, No. 4, 13 (1987).

(93) Seymour, R.B., *Paintindia*, *37*, No. 9, 25 (1987).

(94) Holden, G. and Chen, S., *Elastomerics*, *119*, No. 3, 26 (1987).

(95) U.S. Patent 4,196, 219 (1987).

(96) Sneller, J.A., *Mod. Plastics*, *65*, No. 8, 19 (1988).

(97) Hon, D.N-S. and Tang, L-G., "Atmospheric Oxidation of Cellulose Nitrate Lacquers," Journal of Coatings Technology, *60*, No. 756, 73 (1988).

(98) Calahorra, A., "Investigation of Electrical Resistivity—Pigment Volume Concentration Relationship in Carbon Black Filled Conductive Paint," Journal of Coatings Technology, *60*, No. 757, 25 (1988).

(99) Simon, R.M., Paper No. 10, Fillers '86 Joint Conference, London (1986).

(100) Guder, H. and Beck, F., *Farbe Lack.*, *93*, No. 7, 539 (1987).

(101) Morcello, M., *European Coat. J.*, No. 4, 270 (1988).

(102) Gorviah, S., *Paintindia*, *37*, No. 10, 33 (1987).

(103) Cohen, I., *European Coat. J.*, No. 6, 488 (1988).

(104) Coruviah, S., *Paintindia*, *37*, No. 10, 2 (1987).

(105) Gamero, R., *Elastomerics*, *120*, No. 4, 28 (1988).

(106) Stinson, S., *Chem. Eng. News*, *66*, No. 48, 31 (1988).

(107) Bafford, R.A. and Faircloth, G.E., *Adhesives Age*, *30*, No. 13, 3 (1987).

(108) Nirvan, Y.P.S. and Jagannath, J.U., *Paintindia*, *38*, No. 8, 31 (1988).

(109) Marphatia, R.K., *Paintindia*, *38*, No. 3, 19 (1988).

(110) Rahut, S., *Paintindia*, *37*, No. 12, 29 (1987).

(111) Ashkenazi, B., *Paintindia*, *38*, No. 9, 15 (1988).

(112) Gupta, B. and Shukla, M.C., *Paintindia*, *38*, No. 9, 21 (1988).

(113) Jugran, B.P., et al., *Paintindia*, *38*, No. 10, 39 (1988).

(114) Blandin, H.P., et al., *Prog. Org. Coat.*, *15*, 163 (1987).

(115) Seymour, R.B., *Chem. Bus.*, *43*, No. 5, 19 (1988).

(116) Brady, R.F., *J. Protect. Coat. Linings*, *4*, No. 7, 42 (1987).

(117) Griffiths, J., *Ind. Minerals*, No. 235, 25 (1987).

(118) Anon., *Ind. Minerals*, No. 238, 62 (1987).

(119) Schnable, W., *European Coat. J.*, No. 2, 106 (1988).

(120) Kurtz, W., *Am. Ink Maker*, *65*, No. 6, 21 (1987).

(121) Tsutsui, T., Nishizawa, K., and Ikeda, S., "Plasma Surface Treatment of an Organic Pigment," Journal of Coatings Technology, *60*, No. 765, 107 (1988).

(122) Nakame, K., *J. Adhes.*, *21*, No. 3/4, 229 (1987).

(123) Stein, H.N., *Verfkroniek*, *59*, No. 12, 468 (1986).

(124) Sander, H., *Farbe Lack.*, *93*, No. 4, 257 (1987).

(125) Wu, J.J., Nguyen, H.V., and Flagan, R.C., *Langmuir*, *3*, No. 2, 266 (1987).

(126) Peter, J., *European Paint J.*, No. 1, 50 (1988).

(127) Schrader, J., *European Paint J.*, No. 1, 7 (1988).

(128) Richardson, L., *Surface Coatings Austral.*, *24*, No. 6, 6 (1987).

(129) Cowley, A.C.D., *Rev. Prog. Coloration*, *16*, 16 (1986).

(130) Storey, R.F. and Marcellus, J.E., *Mod. Paint Coat.*, *78*, No. 2, 32 (1988).

(131) Sonn, G., *Am. Ink Maker*, *65*, No. 6, 54 (1987).

(132) Houghton, D., *Mod. Paint Coat.*, *78*, No. 2, 42 (1988).

(133) Moles, P.J., *Mod. Paint Coat.*, *78*, No. 2, 32 (1988).

(134) Dalton, D.L., "Introduction of a Novel, Nonmetallic Fungicide for the Coatings Industry," Journal of Coatings Technology, *60*, No. 761, 45 (1988).

(135) Chattha, M.S., Cassatta, J.C., and Siegl, W.O., *J. Appl. Polymer Sci.*, *33*, No. 5, 1829 (1987).

(136) Yuan, S.Y., et al., *Paint Coat. Ind.*, No. 3, 1 (1987).

(137) Bortolus, P., et al., *Macromol.*, *19*, 2916 (1986).

(138) Tacy, E., *Mfg. Chemist*, *58*, No. 7, 38 (1987).

(139) Messiha, N.N., et al., *Farbe Lack.*, *93*, 630 (1987).

(140) Pendleton, D.E., O'Neill, T.B., and Drisko, R.W., Proc. Steel Structures Painting Council Annual Symposium, p 136 (1987).

(141) Bablick, M., *Mappe.*, *107*, No. 6, 107 (1987).

(142) Hausler, K.G., et al., *Plaste Kautschuk*, *34*, No. 3, 126 (1987).

(143) Mayo, B., Pfau, J.P., and Sharpe, R.E., "Monitoring Pigment Dispersion Using the Free Volume Microprobe," Journal of Coatings Technology, *59*, No. 750, 23 (1987).

(144) Miranda, T.J., "Appliance Coatings: Defects and Their Prevention," Journal of Coatings Technology, *60*, No. 765, 113 (1988).

(145) Basener, N., *European Coat. J.*, No. 1, 513 (1988).

(146) Cheever, G.D., "Use of Fluorescent Microscopy in Studying Solvent Transport in Paint/Substrate Systems I. Sheet Molding Compound (SMC)," Journal of Coatings Technology, *60*, No. 762, 61 (1988).

(147) Bromley, C.W.A., "Nonaqueous Dispersion Polymer Microgels as Film Formers in Architectural Paints," Journal of Coatings Technology, *61*, No. 768, 39 (1989).

(148) Feist, W.C., *Am. Paint Coat. J.*, *73*, No. 9, 38 (1988).

(149) Misra, J.P., Ali, M.R., and Sivasamban, M.A., *Paintindia*, *38*, No. 4, 15 (1988).

(150) Athey, R.D., *European Coat. J.*, No. 1, 40 (1988).

(151) Athey, R.D., *European Coat. J.*, No. 4, 12 (1988).

(152) Kahn, D.D., Contractor, L., and Lakdawa, Z.A., *Paintindia*, *38*, No. 9, 33 (1988).

(153) Miller, D. and Torres, R., *Adhesives Age*, *30*, No. 13, 20 (1987).

(154) Athey, R.D., *European Coat. J.*, No. 3, 218 (1988).

(155) Athey, R.D., *European Coat. J.*, No. 6, 524 (1988).

(156) Montreal Society For Coatings Technology, "Quantifying Pigment Dispersion — II. Iron Oxide Pigments," Journal of Coatings Technology, *61*, No. 770, 73 (1989).

(157) Woelker, G., *European Coat. J.*, No. 1, 32 (1988).

(158) Hajas, J., *European Coat. J.*, No. 4, 288 (1988).

(159) Skerry, B.S., Alavi, A., and Lindgren, K.I., "Environmental and Electrochemical Test Methods for the Evaluation of Protective Organic Coatings," Journal of Coatings Technology, *60*, No. 765, 97 (1988).

(160) Prime, R.B., et al., "Applications of DMA and TGA to Quality and Process Control in the Manufacture of Magnetic Coatings," Journal of Coatings Technology, *60*, No. 761, 55 (1988).

(161) Waggoner, R.A. and Blum, F.D., "Solvent Diffusion and Drying of Coatings," Journal of Coatings Technology, *61*, No. 768, 51 (1989).

(162) Olson, K.L., et al., "Qualitative and Quantitative Determination of Solvent Formulations in Automotive Paints," Journal of Coatings Technology, *60*, No. 762, 45 (1988).

(163) Tait, W.S., "Using Electrochemical Impedance Spectroscopy to Study Corrosion Behavior of Internally Coated Metal Containers," Journal of Coatings Technology, *61*, No. 768, 57 (1989).

(164) Athey, R.D., *European Coat. J.*, No. 1, 34 (1989).

(165) Athey, R.D., *European Coat. J.*, No. 5, 391 (1988).

(166) Choksex, A.C., *Chem. Bus.*, *2*, No. 11, 13 (1989).

(167) Athey, R.D., *European Coat. J.*, No. 4, 297 (1988).

(168) Julian, J.M. and Millon, A.M., "Quality Control of UV Curable Coatings Using FTIR," Journal of Coatings Technology, *60*, No. 765, 89 (1988).

(169) Kestler, J., *Plastics Today*, *1*, No. 3, 1 (1989).

(170) Dammerman, J., *Mod. Paint Coat.*, *78*, No. 2, 28 (1988).

(171) Rich, L.A., *Chem. Week*, *142*, No. 21, 17 (1988).

(172) Savage, P.R., *Chem. Week*, *143*, No. 16, 28 (1988).

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Society Meetings

CHICAGO .... MAY

Awards Night

Fourteen Society Past-Presidents attended the annual Awards Night meeting. Recognized for their dedicated service were: Warren C. Ashley (1955), Carroll M. Scholle (1958), Victor M. Willis (1966), Edward W. Boulger (1968), Raymond R. Pfohl (1969), Thomas Daly (1970), Dennis A. Bergren (1972), Robert Zimmerman (1974), Gus W. Leep (1976), Walter J. Krason, Jr. (1979), W. B. Bartelt (1980), Richard M. Hille (1981), Ross Johnson (1986), Raymond J. Cziczo (1988), and Evans Angelos (1989).

Six members were added to the Society 25-Year Club. Awarded 25-Year Pins were: W.B. Crooker, of Fitz Chemical Corporation; Michael G. Fogel, of Jensen Souders & Associates, Inc.; George Goodwin, of Daniel Products Company; and Lowell D. Pals, of Angus Chemical. Unable to attend the meeting to receive their 25-Year Pins were: Arthur S. Gay, of W.C. Richards Company, and L.F. Kinney, of Sherwin-Williams Company.

Society member Patrick Gorman, of Nuodex, Inc., presented the Nuodex Gavel to incoming President Kevin P. Murray, of DeSoto, Inc. Outgoing President Evans Angelos, of Omya, Inc., handed the Chicago Society Gavel over to Mr. Murray, who in turn, gave Mr. Angelos a Plaque of Appreciation for his valuable contributions to the Society.

Daryl G. Luxmore, of Drew Chemical Corporation, was presented the Society's Outstanding Service Award, for his 13 plus years of dedicated loyalty to the group.

Federation Past-President Terryl F. Johnson, of Cook Paint & Varnish Company, was nominated and elected to Society Honorary Membership.

Twenty-five Year Pins were awarded to the following members: Richard Harger, of Cook Paint & Varnish Company; Thomas Hutsler, of Valspar Corporation; and James Truesdale, of Cook Paint & Varnish Company.

MARK D. ALGAIER, *Secretary*

LOS ANGELES .... JUNE

Business Night

Sandra L. Bowden, of McCloskey Corporation, was elected Secretary by the membership for the 1989-90 year.

Members of the 1989 Western Coatings Societies' 19th Biennial Symposium and Show Committee were presented Certificates of Appreciation. Members present to receive their awards were: Committee Chairman Andrew R. Ellis, of NL Chemicals; Martin F. Balow, of Frazee Industries; James A. Dye, of Trans Western Chem., Inc.; Ronald R. Elliott, of J.R. Elliott Enterprises, Inc.; John Guerra, of Major Paint Company; Steve C. O'Donnell, of Stay & Day Paint Materials Company; Richard C. Sutherland, of E.T. Horn Company; and Geneva H. Wells, of H.M. Royal, Inc.

Environmental Affairs Committee Chairman Dave Muggee, of E.T. Horn Company, noted that crystalline silica in respirable form was coming under Proposition 65 regulation. Warning signs for other substances should be posted if they have not already been so. Two glycol ethers are coming under regulation and warnings have to go on the product labels. 1,1,1-Trichloroethane is being reviewed for inclusion in the Montreal Protocol for regulation as an ozone destroying material.

Treasurer James F. Calkin, of E.T. Horn Company, announced that the Society was awarding 20 scholarships this year with a total value of $16,150.

JAMES D. HALL, *Secretary*

NEW YORK .... MAY

"Polyurethanes as Reactive Cosolvents"

It was announced that a special seminar, "How to Communicate and Deal More Effectively with Others," will be held September 12.

The meeting's speaker was Werner J. Blank, of King Industries, Inc., who spoke on "POLYURETHANES AS REACTIVE COSOLVENTS IN WATER-BORNE COATINGS."

The speaker discussed the progress the U.S. coatings industry has made in reducing the amounts of solvents emitted into the environment. Dr. Blank talked about the use of low molecular weight oligomers as a replacement for glycol ether cosolvents in industrial water-borne crosslinked coatings. The reduction of the solvent emissions, increase in performance, and reduction of the formulation costs also were discussed.

ROGER B. BLACKER, *Secretary*

CHICAGO PAST-PRESIDENTS—Former Chicago Society Presidents attending the May Awards Night meeting include: Front row: Robert Zimmerman, Edward W. Boulger, Victor M. Willis, Warren C. Ashley, and Carroll M. Scholle. Middle row: W.B. Bartelt, Dennis A. Bergren, Raymond R. Pfohl, Thomas Daly, Evans Angelos, and Gus W. Leep. Back row: Raymond J. Cziczo, Ross Johnson, Richard M. Hille, and Walter J. Krason

The Society and the Chicago Paint and Coatings Association awarded $2,000 (two $1,000 grant-in-aids) in joint scholarship monies. The Society offered an additional $1,000 scholarship.

Clifford O. Schwahn

KANSAS CITY............. MAY

Education Night

Federation President-Elect John C. Ballard, of Kurfees Coatings, Inc., and Federation Executive Vice-President Robert F. Ziegler attended the meeting.

Mr. Ballard discussed pending legislature for the Los Angeles/Bay area. He noted that by the year 2000, gasoline lawnmowers, spray cans, and refineries would not be permitted in California. This would cause serious problems for 90 auto refinishers. Mr. Ballard said that Los Angeles was out of compliance for air quality a total of 176 days last year.

The President-Elect also emphasized that education was the primary function of the Federation. He noted the very active Professional Development Committee which has sponsored: Statistical Process Control Seminars; the Project Management Seminar; and this year's Federation Spring Seminar, "Modern Analytical Resources: The Coatings Chemist's Ally."

Executive Vice President Robert Ziegler recapped the Federation's 1988 Paint Show, held in Chicago, IL, and discussed the 1989 Paint Show to be held November 8-10, in New Orleans, LA.

Mr. Ziegler also spoke on Federation membership and scholarships.

Officers elected for 1989-90 are: President—Mark Algaier, of Hillyard Chemical; Vice President—Nick F. Dispensa, of Davis Paint Company; Secretary—H. Jeff Laurent, of F.R. Hall, Inc.; and Treasurer—Craig Hughes, of Farmland Industries, Inc.

Norman A. Hon, of Cook Paint & Varnish Company, will continue to serve as Society Representative to the Federation Board of Directors.

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Snyder's Willow Grove, Linthicum, MD). Gary Morgereth, McCormick Paint Works, 2355 Lewis Ave., Rockville, MD 20851.

BIRMINGHAM (First Thursday—Strathallen Hotel, Birmingham, England). D.A.A. Wallington, Ferro Drynamels Ltd., Westgate, Aldridge, West Midlands, England WS9 8YH.

CDIC (Second Monday—Sept., Dec., Mar. in Columbus; Oct., Jan., Apr. in Cincinnati; and Nov., Feb., May in Dayton). W.E. "Buddy" Whitlock, Ashland Chemical Co., P.O. Box 2219, Columbus, OH 43216.

CHICAGO (First Monday). Karl E. Schmidt, Premier Paint Co., 2250 Arthur Ave., Elk Grove Village, IL 60007.

CLEVELAND (Third Tuesday—meeting sites vary). Richard J. Ruch, Kent State University, Dept. of Chemistry, Kent, OH 44242.

DALLAS (Thursday following second Wednesday—The Harvey Hotel, Dallas, TX). Rhonda Miles, Union Carbide Corp., 2326 Lonnecker Dr., Garland, TX 75041.

DETROIT (Second Tuesday—Ukrainian Cultural Center, Warren, MI). Liana Callas Roberts, A.T. Callas Co., 1985 W. Big Beaver, Suite 308, Troy, MI 48043.

GOLDEN GATE (Monday before third Wednesday—Alternate between Francesco's in Oakland, CA and Holiday Inn in S. San Francisco). Jack Duis, Pacific Coast Chemical, 2424 Fourth St., Berkeley, CA 94710.

HOUSTON (Second Wednesday—Look's Sir-Loin Inn, Houston, TX). Michael G. Falcone, International Paint (USA) Inc., 17419 Little Shoe Ln., Humble, TX 77396.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). Mark Algaier, Hillyard Chemical, P.O. Box 909, St. Joseph, MO 64501.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). James D. Hall, Major Paint Co., P.O. Box 2868, Torrance, CA 90509.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). James Simpson, Reliance Universal, Inc., Resins Div., 4730 Crittenden Dr., P.O. Box 37510, Louisville, KY 40233.

MEXICO (Fourth Thursday—meeting sites vary). Gerardo del Rio SEC, G.B.W. De Mexico, S.A., Poniente 116 No. 576, Nueva Industrial Vallejo, 02610 Mexico, D.F., Mexico.

MONTREAL (First Wednesday—Bill Wongs Restaurant, Montreal). Robert Benoit, NL Chemicals Canada Inc., 4 Place Ville-Marie, Ste. 500, Montreal, Que., H3B 4M5 Canada.

NEW ENGLAND (Third Thursday—Sheraton, Lexington, MA). Arthur Leman, Samuel Cabot Co., 100 Hale St., Nebt, MA 01950.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). Roger P. Blacker, Whittaker, Clark & Daniels, Inc., 1000 Coolidge St., So. Plainfield, NJ 07080.

NORTHWESTERN (Tuesday after first Monday—Jax Cafe, Minneapolis, MN). Terry Strom, Ti-Kromatic Paints, Inc., 2492 Doswell Ave., St. Paul, MN 55108. Winnipeg Section (Third Tuesday—Marigold Restaurant, Winnipeg). Edwin R. Gaskell, Guertin Bros. Coatings & Sealants Ltd., 50 Panet Rd., Winnipeg, MB, R2J OR9 Canada.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). John Berghuis, NL Chemicals Canada Inc., 3450 Wellington Ave., Vancouver, B.C., V5R 4Y4 Canada.

PHILADELPHIA (Second Thursday—Williamson's GSB Bldg., Bala Cynwyd, PA). Christopher H. Huhn, Loos & Dilworth, Inc., 61 E. Green Ln., Bristol, PA 19007.

PIEDMONT (Third Wednesday—Ramada Inn Airport, Greensboro, NC). Gary L. Waters, Sadolin Paint Products, Inc., P.O. Box 669, Walkertown, NC 27051.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). Carol Storme, Valspar Corp., 2000 Westhall St., Pittsburgh, PA 15233.

ROCKY MOUNTAIN (Monday following first Wednesday—Holiday Inn North, Denver, CO). Ginny Carnes, Walsh & Associates, 10190 Bannock St., Denver, CO 80221.

ST. LOUIS (Third Tuesday—Salad Bowl, St. Louis, MO). Terry Gelhot, Spatz Paint, 1439 Henley Industrial Court, St. Louis, MO 63144.

SOUTHERN (Gulf Coast Section—third Thursday; Central Florida Section—third Thursday after first Monday; Atlanta Section—third Thursday; Memphis Section—bi-monthly on second Tuesday; and Miami Section—Tuesday prior to Central Florida Section). James R. Salisbury, Union Carbide Corp., 2043 Steel Dr., Tucker, GA 30084.

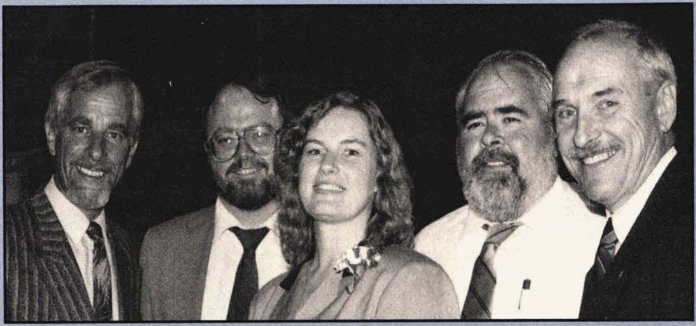
TORONTO (Second Monday—Cambridge Motor Hotel, Toronto). Gerry Parsons, DeSoto Coatings Ltd., 895 Rangeview Rd., Mississauga, Ont., L5E 3E7 Canada.

WESTERN NEW YORK (Third Tuesday—meeting sites vary), Marko K. Markoff, 182 Farmingdale Rd., Cheektowaga, NY 14225.

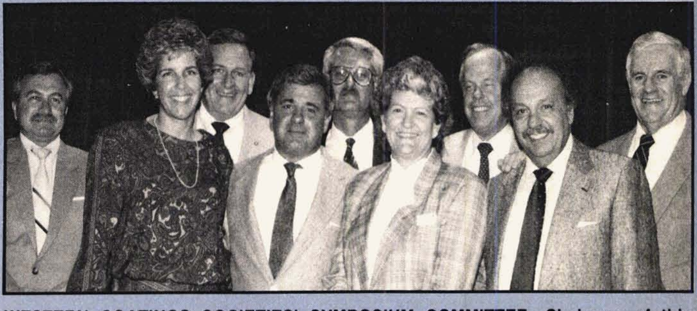
67th Annual Meeting & 54th Paint Industries Show

FSCT 1989

CHICAGO OFFICERS—Society officers for 1989-90 include (l-r): Educational Committee Chairman—John Wamelink; Treasurer—William W. Fotis; Membership Committee Chairman—Gregory McWright; Vice President—Karl E. Schmidt; Associate Representative—Gerald Cuca; President—Kevin P. Murray; and Secretary—Theodore J. Fuhs



LOS ANGELES OFFICERS—Elected to Society officer positions for the year 1989-90 are (l-r): Society Representative— Jan P. Van Zelm; Treasurer—James D. Hall; Secretary—Sandra L. Bowden; President—Parker Pace; and Vice President—James F. Calkin



WESTERN COATINGS SOCIETIES' SYMPOSIUM COMMITTEE—Chairmen of this year's 19th biennial event included Los Angeles Society members: Martin F. Balow, Melinda K. Rutledge, Richard C. Sutherland, Andrew R. Ellis, Ronald R. Elliott, Geneva H. Wells, Steve O'Donnell, John A. Guerra, and James A. Dye

TWENTY-FIVE YEAR CLUB—Inducted into the Chicago Society 25-Year Club are (l-r): Lowell D. Pals, Victor M. Willis (Chairman of the Club), George Goodwin, Michael G. Fogel, and W.B. Crooker

Elections

BALTIMORE

Associate

Lally, Thomas A.—Alford Packaging, Baltimore, MD.

CHICAGO

Active

Billstrand, Charles A.—Sherwin-Williams Co., Chicago, IL.

Flament-Garcia, Mary Jane—Dexter Packaging Products, Waukegan, IL.

Francioli, Susan L.—J.M. Huber Corp., Evanston, IL.

Mitchell, Jay R.—Moline Paint Mfg. Co., Moline, IL.

Shedeker, Robert W.—Quality Chemical Co., Newark, OH.

Thyne, Jacqueline A.—Dexter Packaging Products, Waukegan.

Whitson, Steven C.—Dexter Specialty Ctg., Waukegan.

Associate

Costin, Robert M.—Fitz Chem Corp., Elmhurst, IL.

Crist, Joseph T.—Daicolor-Pope, Naperville, IL.

Fischer, Rick—Eiger Machinery Inc., Bensenville, IL.

Kallal, David A.—Hüls America Inc., Chicago, IL.

Ladow, William R.—U.S. Silica Co., Cedar Lake, IN.

Matera, Michael V.—Hüls America Inc., Chicago.

Palazzo, John A.—Tony Sacco Pigments, Forest Park, IL.

CLEVELAND

Active

Barris, Charles B.—Whittaker Corp., Richmond Heights, OH.

Haase, Tom A.—Sherwin-Williams Co., Cleveland, OH.

Houck, Paul J.—Nanofilm Corp., Strongsville, OH.

Powell, Clois E.—Sherwin-Williams Co., Highland Heights, OH.

Associate

Hershfield, Kevin I.—Cleveland Pigment, Akron, OH.

Milgram, John S.—Aexcel Corp., Willoughby, OH.

Romance, Todd W.—Mooney Chemicals, Inc., Cleveland, OH.

Smead, Jim E.—Jim Smead Chemical, N. Canton, OH.

NEW ENGLAND

Associate

Blair, Raymond E.—Manville Sales Corp., Somersworth, NH.

Koch, Charles J.—Rohm and Haas Co., Milford, MA.

Murray, Richard E.—Arco Chemical Co., Ware, MA.

ROCKY MOUNTAIN

Active

Snider, Thomas A.—Kwal-Howells, Inc., Denver, CO.

Woods, Robert A.—Fire Research Lab, Albuquerque, NM.

People

Henkel Corporation, Gulph Mills, PA, has announced the appointment of **Robert T. Betz** as Executive Vice President. Mr. Betz will head the newly acquired Emery Oleochemicals Group.

Charles B. Edwards and Company, Minneapolis, MN, has appointed **Lisa Lenarz-Wyatt** as Color Lab Supervisor. Ms. Lenarz-Wyatt has over 10 years of color matching and management experience in the plastics industry. Her background includes both hands-on and supervisory work with new color formulations.

Organizational changes in American Cyanamid Company's Resins Products Department, Wayne, NJ, have been announced. The current moves promote **Raymond C. Zizik** to Director of Coatings Industry Sales, and **Charles A. Van Fleet** to Project Manager/Powder Resins.

P. Joe Kress has joined the sales staff of the Container Group of Betz MetChem, Horsham, PA, as an Industry Specialist. Mr. Kress has conducted research in the container industry and is co-inventor of two patents for environmentally safe surface treatments that are used on drawn and ironed cans to prevent staining. He is a member of the American Chemical Society.

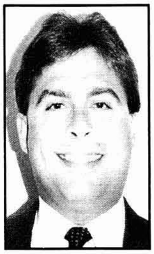
The following appointments have been made by the Chemicals Division of J.M. Huber Corporation, Havre de Grace, MD: **Thomas J. Krieg**—Sales Director; **Barry Radulski**—Business Development Director; **John E. Luppino**—Division Purchasing & Logistics Director; **Patrick E. Jackson**—Production Superintendent; and **Charles Hoover**—Plant Engineer.

Kurfees Coatings, Inc., Louisville, KY, has announced the appointment of two Sales Representatives. **Thomas W. Pollard** was named Vice President and Regional Sales Manager, responsible for sales in New York, New England, Pennsylvania, Ohio, Illinois, Indiana, Michigan, Wisconsin, Minnesota, and Iowa. **Jeff Meyer** will be servicing the firm's customers in northern Illinois, northern Indiana, and parts of Wisconsin and Michigan.

R.T. Betz

L. Lenarz-Wyatt

C.F. Kuhn



C.J. Baudendistel

Charles F. Kuhn has retired after a 37-year career with Champion Pneumatic Machinery Company, Inc. of Princeton, IL. Mr. Kuhn started as a Machinist with Champion in 1952, and served in that position for the next ten years. In 1962, he was promoted to Quality Control Manager, a position he held until retirement.

Los Angeles Society Member **William R. Norris** has been named Sales Manager for the Coatings and Adhesives Raw Materials Division of A.J. Lynch & Company, Oakland, CA. Most recently serving as Senior Account Executive, Mr. Norris has been with the firm for 19 years.

The Sonneborn Division of Witco Corporation, New York, NY, has made a number of managerial changes. **Frank Marcotte,** Vice President/Technology, joined Witco in 1972, and was most recently Vice President/Technical. **Robert Morie,** Vice President/Special Projects, has 35 years' experience with Witco and recently served as Vice President/Marketing. **Ralph Abosch** becomes General Sales Manager/Refined Products, a new position which reflects the division's recent classification of product lines as "refined products" and "specialty products" for sales and marketing purposes. Former Regional Sales Manager **Tom Pensak,** a 12-year Witco veteran, now serves as Business Manager/Refined Products.

In addition, **Paul Laura** has been appointed Marketing Manager/Specialty Products, with worldwide sales responsibilities. Most recently Director of Product Management, **Arthur Sacco** becomes Business Manager/Specialty Products. **Paul Tietze,** Technical Services Director after 20 years with the company, will add Customer Service to his responsibilities.

NL Chemicals, Inc., Hightstown, NJ, has named **Craig J. Baudendistel** as Salesman of the Year. Based in Cleveland, OH, Mr. Baudendistel represents the company in its central sales region, serving the New York, Ohio, and Pennsylvania metropolitan areas. Mr. Baudendistel was selected as top salesman for his region and ranked first among the leading salesman from each of the firm's five sales regions.

George M. Findling has been named Vice President and General Manager/Resin Group, U.S. Market, by Akzo Coatings Inc., Troy, MI. In his new position, Mr. Findling will be responsible for the overall management of Akzo's four resin and ink vehicle producing operations and will direct their continued expansion in North America. He has been with the firm since 1980.

In addition, the appointment of **James H. Miller** as Vice President, Chief Financial Officer has been announced. Mr. Miller will oversee the financial planning activities of the corporation.

The Pulp Chemicals Association, New York, NY, has elected the following Officers for 1989-90: President—**Robert T. Schoepflin,** Union Camp Corp., Wayne, NJ and Vice President—**Ray E. King,** Gilman Paper Co., Woodcliff Lake, NJ. Named to the Executive Committee of the organization are: **E. Thomas Bridges,** Great Southern Paper Co.; **Charles Gardner,** Champion International, Asheville, NC; **Laurence Loh,** Reichhold Chemicals, Inc., Coating Polymers & Resins Div., Pensacola, FL; **Hugh S. Norman,** B.C. Chemicals, Ltd., Prince George, B.C.; **Manco L. Snapp, Jr.,** Arizona Chemical Co., Panama City, FL; and **William A. Tuck, Jr.,** Bowater Inc., Greenville, S.C.

The appointment of **Robert J. Seidewand** as Manager, Applications Development and Technical Service of ICI Resins U.S., Wilmington, MA, has been announced. A 17-year veteran of ICI Paint's Glidden Coatings and Resins Division in Strongsville, OH, Dr. Seidewand has relocated to Wilmington, and will manage all technical service and applications development work for adhesives, coatings, floor care, and graphic arts markets.

Also, the naming of **Paul H. Stenson** as Senior Research Chemist has been announced by ICI. Dr. Stenson will direct the development of the firm's 100% solids and water-borne radiation curable polymer technologies for the North American market.

Man-Gill Chemical Company has named the following for executive-level positions: **Peter H. Russell**—Executive Vice President/Chemical Group; **Warren G. Runestrand**—Vice President/General Sales; and **Charles "Chuck" O'Brien**—Director of Training and Development. All will work out of the company's headquarters in Euclid, OH.

David Kallal and **Michael Matera** have joined the Colorants & Additives Group of the Coatings Division of Hüls America Inc., Piscataway, NJ, as Sales Representatives. Mr. Kallal will oversee the sales of Hüls colorants and additives in Missouri, Kansas, Minnesota, and the Chicago area. Mr. Matera will be responsible for the company's sales in Michigan, Indiana, and the Chicago area.

In addition, **Marvin Landau** has been named Technical Service Manager of the group's Solvent Coatings Additives product area. Prior to joining Hüls, Mr. Landau was a Technical Manager at Cosan Chemicals, and was also previously employed by the Technical Service Group of Tenneco Chemicals.

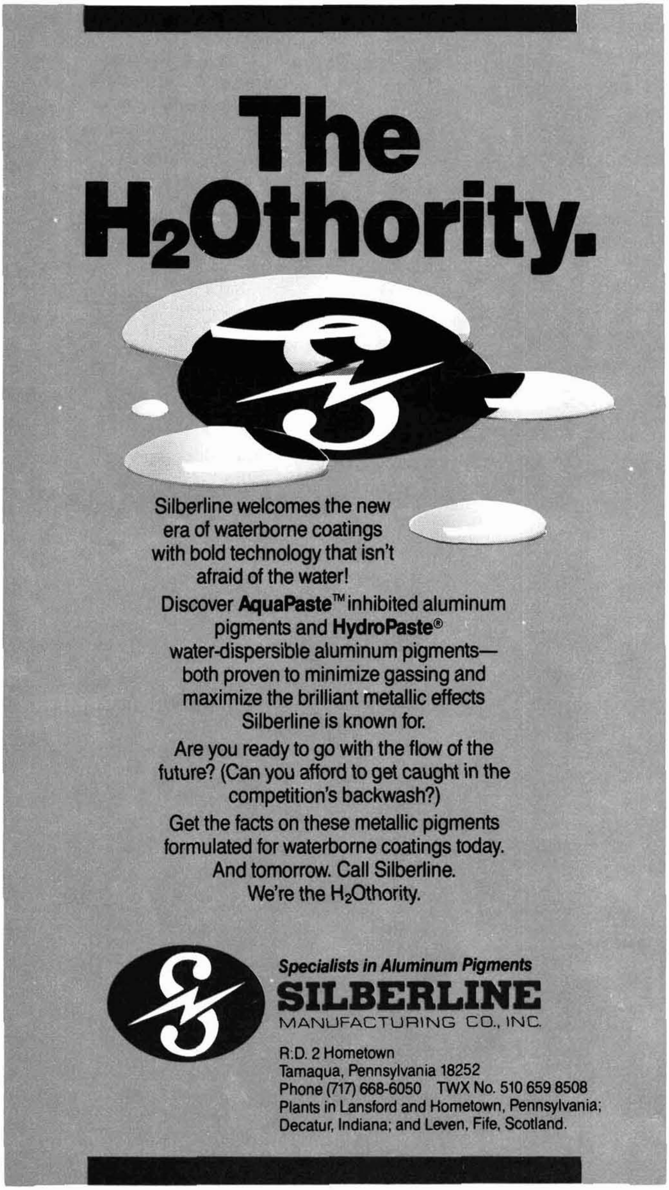
Douglas Mattscheck has been appointed Senior Vice President/General Manager of Polomyx Industries, Inc., a division of Surface Protection Industries, Los Angeles, CA. Mr. Mattscheck has experience in the building products industry, having served as National Sales and Marketing Manager for H.B. Fuller Company and the Schlegel Corporation.

Robert L. Marini, General Manager of Cabot Stains' nine-state Western Division, has been named Corporate Vice President. He will continue to run western operations from the firm's manufacturing, distribution, and marketing facility in Hayward, CA. Samuel Cabot Inc., is headquartered in Newburyport, MA.

Ronald J. Wingender has been named Manager of Analytical Services for the Dexter Corporation's Packaging Products Division, Waukegan, IL. Dr. Wingender was formerly associated with the Chemical Technology Division of Argonne National Laboratories.

Ashland Chemical Company, Columbus, OH, has appointed **Michael W. Swartzlander** to its newly created position of Manager/Business Development. Mr. Swartzlander will work on business opportunities resulting from internally developed new products and services.

Under his new position as Manager of Distributor and Warehouse Sales with Cyprus Industrial Minerals Company, Engelwood, CO, **Darrell E. Young** will be responsible for talc, chlorite, and barytes sales from more that 20 distribution centers throughout the United States and Canada. He has been with the firm since 1985.



Robert D. Kennedy, of Union Carbide Corporation, has been elected Chairman of the Board of the Chemical Manufacturers Association, Washington, D.C. He succeeds **Robert C. Forney,** of E.I. du Pont de Nemours & Company. **John W. Johnstone, Jr.,** of Olin Corporation, was elected Vice Chairman of the Board, and **H. Eugene McBrayer,** of Exxon Chemical Company, was elected Chairman of the Executive Committee. **Robert A. Roland** was re-elected President of the Association.

Mooney Chemicals, Inc., Cleveland, OH, has announced the following promotions: **Eugene Bak**—Senior Vice President; **Thomas E. Fleming**—Vice President/Marketing; and **John R. Holtzhaueser**—Controller.

Michael R. Brennan has joined the staff of Velsicol Chemical Corporation, Rosemont, IL, as the Chemical Group Marketing Manager. Mr. Brennan joins Velsicol with over 13 years of experience with the Unocal Chemicals Division Petrochemicals Group.

Croda Inks Corporation, Niles, IL, has appointed **Dan Payseur** as Southeast Area Sales Manager. Mr. Payseur's previous experience includes 12 years in the ink industry as a Formulator, then as a Sales Technical Representative. He will be based at the company's Atlanta, GA, location.

Louis F. Savelli, Automotive Materials and Systems Director, has been named Director of Du Pont's Finishes Division, Troy, MI. Mr. Savelli will have responsibility for Du Pont's three paint and coatings businesses: original equipment automotive finishes, refinish systems for the auto body repair market, and industrial and maintenance coatings. He has been with the company since 1959.

James Litrun has been appointed National Sales Manager for the Cab-O-Sil Division of Cabot Corporation, Tuscola, IL. He will be responsible for domestic sales of Cab-O-Sil® fumed silica.

In addition, **Mark Cornelius** was named Western Regional Sales Manager covering states west of the Rockies and western Canada.

Ferro Corporation, Cleveland, OH, has named **Salvatore C. Lovano** Business Manager/Powder Coatings. Mr. Lovano will assist key operating management personnel with business evaluations, staffing, manufacturing and marketing decisions, as well as acquisition coordination.

Obituary

Frank N. Reckless, Consultant, died on May 9, 1989.

Mr. Reckless joined Le Pages Ltd., in Canada, in 1958 as a Coatings Chemist. His specialization in the cosmetic and adhesives industry culminated in the establishment of his own consulting firm.

Mr. Reckless' association with the Toronto Society for Coatings Technology began in 1978; he served as Chairman of the By-Laws and Specifications Committee since 1980.

Your Delta Drawing Ticket—

Don't Leave for the Hilton Without It!

• New Orleans Hilton •
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New Orleans, Louisiana
November 8-9-10, 1989

As a registrant to the 1989 FSCT Annual Meeting and Paint Industries' Show, November 8-10, in New Orleans, you have the opportunity to win a pair of Delta Air Lines first-class, round-trip tickets for any destination in the continental United States.

Tickets will be distributed with Advance and On-Site Registrations. Entries must be made at a special location at the New Orleans Hilton Exhibition Hall—site of many exciting and informative exhibits of the Show.

The drawing will be held at the Hilton Exhibition Hall at 11:00 a.m., Friday, November 10. Announcement of the winning entry will be made at the Federation's Annual Luncheon on Friday. Winner need not be present to win, but why not plan to be at the Luncheon to pick up your prize?

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Available in the U.K. from: Birmingham Paint, Varnish and Lacquer Club, c/o Ray Tennant, Carrs Paints Ltd., Westminster Works, Alvechurch Rd., Birmingham B31 3PG, England

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ALL INFORMATION BELOW MUST BE COMPLETED

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Check the one block which applies *most specifically* to the company or organization with which *you* are affiliated.

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Federation of Societies for Coatings Technology

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Total Statistical Process Control Program Highlights Kent State University's Fall Slate of Coatings Courses

Three fall coatings courses have been slated by the Coatings Group of Kent State University (KSU), Kent, OH. All three programs have been held in prior years.

The course titles and their dates are, as follows: "Industrial Painting: Application Methods"— October 3-4; "Total Statistical Process Control for Coatings and Polymers"— October 23-25; and "Introduction to Coatings Technology"— November 27-30.

The "Industrial Painting" course will be presented by Norman Roobol, of NR Consulting. An emphasis on paint application methods will be featured. The program also will present common customer problems and their solutions.

Means to reduce variation in quality will be highlighted during the "Total Statistical Process Control" class. The conference is designed to cover 12 topics pertinent to statistical process control, including: principles and practice of quality control, fundamentals of statistical quality control as related to product improvement for coatings and polymers, basic and advanced charting techniques, a critical evaluation of the Taguchi method, implementing a total quality improvement system, quality assurance in manufacturing, and other additional topics.

The course is designed for individuals in the coatings, adhesives, elastomers, plastics, and chemical industries who need to know the practical application of statistical quality control concepts. The program coordinator will be H. Earl Hill, Coatings Consultant, who will be assisted by 12 leading experts in quality control.

The third course to be offered, "Introduction to Coatings Technology," is intended to help technical and nontechnical people new to the coatings field to understand the industry in its progress from art to science. Raw materials and their functions in architectural and industrial finishes, as well as factors that influence the composition, formulation, and performance of coatings will be presented. John A. Gordon, of Pacific Technical Consultants, will oversee the coatings technology class.

For more information, contact the Programs Manager, Carl J. Knauss, Chemistry Department, KSU, Kent, OH 44242.

Short Course Schedule Set at Missouri-Rolla

The Coatings and Polymer Science Program at the University of Missouri-Rolla has finalized its fall schedule of short courses. Dates and titles include:

"59th Introductory Short Course—The Basic Composition of Coatings"— September 25-29;

"19th Introductory Course on Paint Formulation"— October 9-13;

"Introduction to Polymer Chemistry"— October 23-27;

"Basic Coatings for Sales and Marketing Personnel"—December 13-15;

Also announced are the following courses for spring 1990:

"Basic Coatings for Sales and Marketing Personnel"—February 7-9;

"20th Introductory—Paint Formulation"—March 12-16;

"60th Introductory Short Course—The Basic Composition of Coatings"—March 26-30;

"Physical Testing of Paints and Coatings"—May 14-18; and

"Basic Coatings for Sales and Marketing Personnel"—July 18-20.

Additional details may be obtained by contacting the University of Missouri-Rolla, Coatings and Polymer Science Program, Chemistry Department, 142 Schrenk Hall, Rolla, MO 65401.

University of Detroit Announces Fall Short Course Schedule

The Division of Continuing Professional Education at the University of Detroit will sponsor six coatings courses scheduled to begin in September.

"Coatings Laboratory," which begins on September 11, is a "hands-on" course covering the use and operation of equipment used in quality control and R & D laboratories. Tests will be conducted which relate to paint manufacturing processes and how these results relate to field performance.

"Fundamentals of Automotive Paint Systems" is a ten-week course which provides a comprehensive survey of basic automotive paint raw materials and process systems. This course begins on September 11.

A six-week course on "Electrodeposition" is slated for September 11 also. This course will cover the history and evolution of electrocoat; metal pretreatment and E-coat chemistry; calculations for feed makeup; ultrafiltration; anolyte; and trouble-shooting.

"Surface Coatings Technology" is a ten-week course intended for new employees and individuals entering the coatings industry. Some of the subjects to be covered include: principles of formulation; color concepts and color matching; white and extender pigments; color pigments; pigment dispersions; paint calculations; paint driers and additives; formation and structure of paint films; and solvents.

Beginning on September 12 will be a ten-week program on "Polymer Technology for Coatings." The sessions will include lectures on basic polymer concepts, polymers commonly used in coatings, and the relationship between the structure of the polymers and the properties of the coatings. Polymers for automotive coatings will be emphasized.

"Principles of Color Technology" is a seven-week course scheduled to begin on September 18. This introductory course is intended for those who have no prior experience in the field. Sessions following the first night's lecture will consist of matching four solid colors and eight "metallics." Students will do their own spraying. For further information on this course, contact Dan Melnyk at Chrysler Corporation, (313) 252-8998.

Preregistration for these courses is recommended. For additional information, contact the University of Detroit, Continuing Education, 4001 W. McNichols Rd., Detroit, MI 48221-9987.

1991 West Coast Symposium Slated for San Francisco

The Western Coatings Societies' 20th Biennial Symposium and Show is scheduled for February 18-20, 1991, at the Hilton Hotel, in San Francisco, CA.

The event is sponsored by the Golden Gate, Los Angeles, Pacific Northwest, and Rocky Mountain Societies. Included in the activities will be a technical program and an exhibition of goods and services supplied to the coatings industry.

General Chairman for the event is Patricia Shaw, Davlin Coatings, Inc. Gordon Pioch, of Triangle Coatings, Inc., is Co-Chairman and Ted Favata, of Performance Coatings, is Treasurer. Leon Persson, of Harcros Chemicals, will serve as Advisor. Other Committee Chairmen include: *Exhibits*—Tom Dowd, Dowd & Guild, Inc.; *Entertainment*—Barry Adler, FRP Supply; *Registration*—Don Hillback, E.T. Horn Co.; *Spouses Program*—Evelyn Adler; *Publicity*—Patricia M. Stull, Pacific Coast Chemical Co.; and *Technical Program*—Dr. Robert Athey, Athey Technologies.

Chemical Technician—Coatings Courses Sponsored by George Brown College

George Brown College will sponsor evening courses in Coatings and Plastics Technology at the St. James Campus, Toronto, Ontario, Canada. The courses are approved by the Ministry of Colleges and Universities and certified jointly by the College and the Toronto Society for Coatings Technnology. The courses are designed to be taken separately. Credits may be accumulated towards the Chemical Technician—Coatings Certificate and/or Diploma.

Courses being offered include: "Resins—A," "Coatings Laboratory," "Organic Coatings," and "Resins—C."

The "Resins—A" course deals with quality control, curing, properties of unsaturated polyesters, alkyds, and epoxy resins.

"Coatings Laboratory" will cover topics such as quality control of raw materials, preparation and evaluation of lacquers, varnishes, and water-borne coatings.

The course on "Organic Coatings" focuses on raw materials: oils, resins, solvents, driers, additives, and primer and extender pigments. Also to be discussed are formulations and properties of organic coatings, including principles of formulation; film formation; dispersion; testing; lacquers, and varnishes; trade sales, industrial corrosion, chemical resistant, powder, high solids, and water-borne coatings. Preparation and application methods will be covered.

"Resins—C (lab)" will focus on: quality control; curing; film formation; properties of lacquer, hydrocarbon, phenolic, amino, silicone, and water-borne resins.

In addition, "Resins—C" will be offered in a lecture-type format which will explore similar topics, as well as raw materials, manufacturing methods, chemistry, film formation, and properties.

Enrollment for some of the courses is limited. For additional information, contact Mr. P. Rodak, George Brown College, St. James Campus, 200 King St., E., Toronto, Ontario, M5T 2T9 Canada.

Lehigh University to Host 64th ACS Colloid Symposium

Lehigh University, Bethlehem, PA, will host the 64th American Chemical Society (ACS) Colloid and Surface Science Symposium, on June 18-20, 1990. The conference is sponsored by the ACS Division of Colloid and Surface Chemistry.

The program will feature papers on the following topics: "Adhesion of Proteins and Cells to Particles/Surfaces"; "Organic Thin Films"; "Colloidal and Surface Chemistry of Coals"; "Rheology of Concentrated Dispersions and Associative Thickeners"; "Monolayers and Thin Polymeric Films in Electronics"; "Catalysis/Surface Sciences" ("Molecular Design of Metal Oxide Catalysts" and "Catalysis by Oxidic, Sulfidic, and Colloidal Systems"); "New Surface Analysis Techniques/Advances in Electron Spectroscopy"; "Polymer Colloids"; "Substrate/Interface/Polymer: Chemistry and Structure"; and "Acid-Base Interactions: Relevance to Adhesion Science and Technology."

General papers also will be presented in addition to a symposium on nucleation.

More information can be obtained by contacting M.S. El-Aasser, Emulsion Polymers Institute, Lehigh University, 111 Research Dr., Bethlehem, PA 18015.

"SSPC 89" Scheduled for Houston, Dec. 3-8

The National Conference and Exhibition of the Steel Structures Painting Council (SSPC) is scheduled for December 3-8, at the George R. Brown Convention Center in Houston, TX. This year's theme is "Protective Coatings for Industrial Structures."

The technical program will consist of seminars on a variety of topics, including: "Overseas Coating Technology, Part 1"; "Overseas Coating Technology, Part 2"; "Regulations"; "Coatings for Concrete Floors"; "Coatings for the Power Industry"; "Pipeline Coatings"; "Coatings for the Petrochemical Industry"; "Research and Development"; "Offshore Coatings, Part 1"; "Offshore Coatings, Part 2"; "Bridge Coatings Forum"; "Abrasives and Blast Cleaning"; and a special session on "Low VOC Research and Standards."

A total of nine tutorials will be conducted during the SSPC conference. The formal workshop/training sessions are: "Inspection Instruments Workshop"; "SSPC Painting Contractor Certification Program"; "Maintenance Options for Aged Structures"; "Economics of Protective Coatings"; "Application Techniques"; "Failure Analysis"; "Lead Paint Containment and Disposal"; "Soluble Salts: Significance, Detection, and Removal"; and "Plant Maintenance Survey."

The Hyatt Regency Hotel will serve as SSPC headquarters hotel. For more information, contact Rose Mary Surgent, Meetings Manager, SSPC 89, 4400 Fifth Ave., Pittsburgh, PA 15213.

Polymer Analysis to Be Focus Of International Symposium

The Third International Symposium on Polymer Analysis and Characterization will be held July 23-25, 1990, in Brno, Czechoslovakia. The conference is organized in conjunction with the Czechoslovak Academy of Sciences.

The theme of this year's symposium is "Recent Advances in Polymer Analysis and Characterization." The three-day program will consist of poster sessions, invited lectures, and round table discussions. Topics will include: chromatography, spectroscopy, light scattering, rheology, thermal analysis, and solution properties of polymers.

A short course on gel permeation chromatography will precede the program.

For further details, contact Howard G. Barth, ISPAC Chairman, Du Pont Co., Experimental Station E228/238, P.O. Box 80228, Wilmington, DE 19880-0228 or Josef Janca, Institute of Analytical Chemistry, Czechoslovak Acad. Sci., Leninova 82, 611 42 Brno, Czechoslovakia.

CALL FOR PAPERS

Electrochemical Society Symposium
on
"Metallized Plastics: Fundamental and Applied Aspects II"

Montreal, Quebec, Canada • May 6-11, 1990

The Dielectrics and Insulation Division of the Electrochemical Society invites all interested persons to submit papers for presentation at their 177th Meeting, to be held in Montreal, Quebec, Canada, on May 6-11, 1990.

The symposium is designed to provide a forum for discussion of the latest developments in the field of metallized plastics. Unique metallization techniques, new materials, and specialized analysis techniques relevant to the topic will be welcome.

Suggested topics include, but are not limited to: various methods to metallize plastics; investigation of interfacial interactions; adhesion aspects of metallized plastics; durability of bonds; adhesion measurement techniques; diffusion, permeability, and related phenomena; and various plastic surface treatments.

In addition to contributed papers, there will be a number of invited overview papers dealing with various ramifications of metallized plastics.

A 75-word abstract and a one-page extended abstract for the extended abstracts volume must be submitted to either of the symposium chairmen by November 1.

A hardbound proceedings volume is planned for this symposium. A full manuscript is required by April 1. Papers will be reviewed prior to inclusion in the proceedings volume.

Camera-ready typing mats for short and extended abstracts are available from the Electrochemical Society, Inc., 10 S. Main St., Pennington, NJ 08534-2896.

Address all suggestions and inquiries to the Symposium Chairmen: K.L. Mittal, IBM U.S. Technical Education, 500 Columbus Ave., Thornwood, NY 10594, or J.R. Susko, T30/257-3, Box 8003, IBM Corp., 1701 North St., Endicott, NY 13760.

Du Pont Management Services to Sponsor Autumn Schedule of Seminars and Workshops

Two seminars and two workshops sponsored by Management Services, Du Pont Company, Wilmington, DE, have been scheduled for the fall.

The two-and-one-half day program, "Fundamentals of the Resource Conservation and Recovery Act (RCRA)," is designed to teach site environmental coordinators and those responsible for managing hazardous waste materials how to comply with the RCRA. Dates and locations for the program are: September 19-21—Wilmington; October 24-26—Dallas, TX; and November 14-16—Williamsburg, VA.

A new, comprehensive two-day seminar designed to teach environmental and plant managers the basics of ground water hydrology has been slated. "Fundamentals in Ground Water Hydrology" is scheduled for October 17-18 and November 14-15 in Houston, TX. Its workshop format will allow participants to examine and solve a series of hydrogeological field problems.

"Experimentation for Robust Product Design" is a novel, two-and-one-half day, computer-integrated workshop which focuses on the design of experiments for building quality into products and processes. Seminar sessions will be held in Wilmington on the following dates: September 13-15, October 24-26, and December 5-7.

Forming, implementing, and maintaining a successful waste minimization program are the focus of the two-day "Minimizing Waste: An Action Plan" workshop. The sessions are scheduled for September 26-28, in Philadelphia, PA, and October 11-13, in Houston.

Additional details are available from Du Pont Management Services, Montgomery Bldg., Box 80800, Wilmington, DE, 19880-0800.

Coatings Training Courses Offered by KTA-Tator

The schedule for Fall 1989 and Winter/Spring 1990 Coatings Inspection Training Courses sponsored by KTA-Tator, Inc., Pittsburgh, PA, has been released.

The introductory (Level I) training courses are designed to train or refresh coating personnel in the fundamentals of coatings technology, surface preparation, application, and inspection. Level II courses are for those well-schooled in the field who wish to further their knowledge in areas of coating failure analysis and field problem solving.

The Fall 1989 schedule includes: Level I—"Immersion Service Coatings and Linings"—September 26-28; Level I—"Maintenance/Industrial Painting"—October 31-November 2; and Level II—"Coating Failure Analysis"—November 28-30.

Seminars slated for Winter/Spring 1990 are: Level I—"Bridge/Highway Structures"—January 23-25; Level II—"Coating Failure Analysis"—February 27-March 1; and Level I—"High Performance Coatings"—March 13-15.

Subjects that will be covered during the presentations include: corrosion theory and current coating technology; generic coating types, characteristics, and uses; surface preparation equipment; coating application equipment; coating inspection techniques and use of inspection instrumentation; coating inspection documentation; painting specification and procedure writing, review, and interpretation; and coating failure investigation, prevention, and problem solving.

For details, write KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275.

Rheology Societies To Meet in Montreal

The 61st Annual Meeting of the Society of Rheology, in conjunction with the First Annual Meeting of the Canadian Rheology Group and the First Inter-American Conference on Rheology, will be held October 21-26, at Le Grand Hotel, in Montreal, Quebec, Canada.

The Plenary Lecture, "Reflections on Entanglements, Interactions, and Matters Rheological," will be delivered by H.P. Schreiber, of Canada.

Presentations during the meeting will focus on "Multiphase Systems and Biopolymers," "Theoretical and Solid Phase Rheology," and "Experimental Rheology."

In addition, a short course on "Rheology and Micromechanics of Dispersions," will take place October 21-22.

For more information, contact L.A. Utracki, Program Chairman, National Research Council Canada, Industrial Materials Research Institute, 75 boul. de Mortagne, Boucherville, Quebec, Canada, J4B 6Y4.

CALL FOR PAPERS

American Chemical Society Symposium

"High Solids Coatings"

Washington, D.C. • August 26-31, 1990

The American Chemical Society (ACS) Division of Polymeric Materials: Science and Engineering (PMSE) invites prospective authors to submit papers for presentation at the symposium on "High Solids Coatings," scheduled for August 26-31, 1990, in Washington, D.C.

The symposium will address all scientific and technological aspects of liquid high solids coatings except for radiation curable coatings. Papers on practical aspects of the subject and those focusing on underlying scientific and engineering principles will be considered.

Appropriate topics include, but are not limited to: synthesis of oligomers and polymers; crosslinkers and crosslinking reactions; catalysis; advances with conventional binders—polyesters, acrylics, aminos, polyurethanes, and epoxies; newer types of coatings binders; solvents and reactive diluents; nonaqueous dispersions; pigments; additives; formulation; production of oligomers and polymers; production of coatings; pigment dispersion; properties of oligomers and polymers; rheology of high solids coatings—sag control; structure of films—network theory; film properties—adhesion, corrosion, resistance, weatherability, etc.; application—electrostatics and robotics; high solids coatings for specific uses—automotive, appliance, industrial, architectural, etc.; regulatory and safety issues; and quality and statistical quality control.

The symposium will update the 1986 ACS/PMSE symposium on "High Solids Coatings," and also will focus on liquid high solids coatings.

Short (up to five page) papers will be printed in the Polymeric Materials Science and Engineering preprints. A Proceedings Book will be published. An expanded version of each preprint paper will be eligible for publication as a chapter in the book.

All interested persons should submit a preliminary title by December 1; a 200-word abstract (on ACS form) by April 10; a preprint manuscript (on PMSE paper) by May 10; and a book manuscript (on ACS paper) by the time of the symposium.

Additional information may be obtained by contacting Prof. Frank N. Jones, Polymers & Coatings Department, North Dakota State University, Fargo, ND 58105.

Battelle to Sponsor International Symposium On Separation Technology, December 5-7

An intensive, three-day international symposium on separation technology will be sponsored by Battelle, Columbus, OH, December 5-7. The critical role of solid/liquid separation processes in waste management and productivity enhancement will be the focus of the program.

The symposium will feature several world-recognized experts in separation technology from industry, academia, and government discussing recent developments and applications of separation methods in industrial processing, including acoustic and electro-acoustic dewatering, filtration, and electro-kinetics.

Concurrent sessions will explore case histories and technology assessments of conventional and progressive theories of industrial and municipal waste management, land contamination issues, and productivity enhancement, including: process fundamentals of sludge dewatering, sludge dewatering processes, novel dewatering processes, membranes and membrane presses, industrial coal and mineral wastes, flocculation, in-situ remediation, beneficial reuse of sludges, and electrotechnologies.

The symposium is structured toward managers, researchers, and operations personnel in chemical, mineral, coal, food, biological, environmental (sludge treatment), electronics, and related industries.

For additional technical details, contact H. Muralidhara, Battelle, 505 King Ave., Columbus, OH 43201-2693. Registration information is available from Philip Wells, The Conference Group, 1989 W. Fifth Ave., Suite 5, Columbus, OH 43212.

Fisons Instruments to Host Industrial Rheology Seminar

A series of three-day seminars on "Principles and Practices of Applied Industrial Rheology" will be sponsored by Fisons Instruments, Valencia, CA.

Among topics to be discussed are: concepts of absolute viscosity measurement, calculating shear rate in industrial applications, types of flow behavior, principles of dynamic measurements, instrument design, and modeling viscoelastic behavior.

The seminars are scheduled for: September 12-14—Quebec, Canada; October 17-19—Saddle Brook, NJ; November 14-16—Houston, TX; and November 28-30—Oakland, CA.

For further details, write the Seminar Coordinator, Fisons Instruments, 24911 Avenue Stanford, Valencia, CA 91355.

NACE Offers Home Study Course on Protective Coatings

The National Association of Corrosion Engineers (NACE), Houston, TX, has made available the home study course, "Protective Coatings and Linings." The course covers the same material as NACE's formal five-day seminar.

The home study class covers: coatings materials, application of protective coating systems, common coating defects and failures, and information "from selection to installation."

The course provides a 200-page notebook which contains outlines, figures, unit quizzes, assistance request mailers, and a final project assignment. The book "Corrosion Prevention by Protective Coatings" by Charles G. Munger serves as a reference text.

The cost of the new home study course is $475 for members and $550 for nonmembers.

For additional information about the NACE home study programs, write Education and Training Dept., NACE, P.O. Box 218340, Houston, TX 77218.

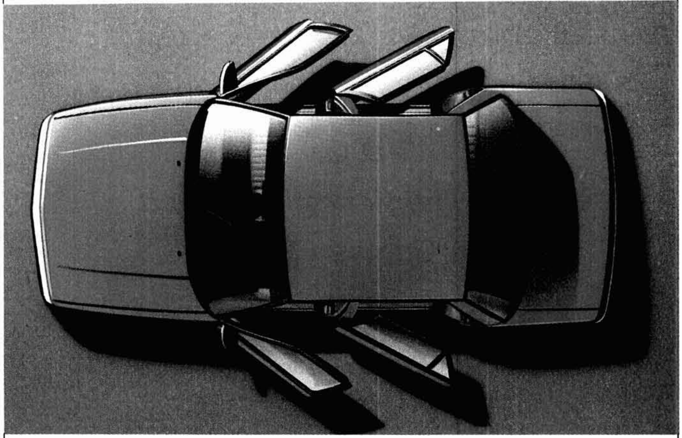
Short Course on Color Offered by RIT, Oct. 25-26

The Rochester Institute of Technology's (RIT) Munsell Color Science Laboratory, Rochester, NY, will offer a short course on "Principles of Color Reproduction," on October 25-26.

Dr. R.G.W. Hunt, visiting Professor of Physiological Optics, City University of London, will present the program which will include topics such as: CIE systems, color discrimination, trichromatic color reproduction, additive and subtractive methods, sensitometry, television technology, printing technology, and result assessment.

The course will be held in the Chester F. Carlson Memorial Building on the RIT Campus.

For information, contact Barbara Capierseo, Munsell Color Science Laboratory, RIT, One Lomb Memorial Dr., P.O. Box 9887, Rochester, NY 14623-0887.



Literature

t-Butyl Hydroperoxide

A brochure characterizing a clear, colorless, stable aqueous t-butyl hydroperoxide/water binary system has been issued. Data on uses in free radical polymerization, specialty chemical syntheses, and industrial oxidation processes are also presented. Copies of the brochure, "T-Hydro TBHP Solution," are available from the Marketing Communications Dept., ARCO Chemical Co., 3801 West Chester Pike, Newtown Square, PA 19073.

Fillers

An updated 24-page brochure describes how a line of diatomite functional fillers are designed to provide uniform gloss and sheen control in paint. In addition to a discussion on these fillers, the brochure offers tips for their use and lists pigment formulations using the product. For a copy of the bulletin on Celite® functional fillers for the coatings industry, designated INT-330, contact Manville Inquiry Dept., 1601-23rd St., Denver, CO 80216.

Bleaching Gun

Technical data is obtainable on a bleaching gun which is designed specifically for bleaching wood surfaces prior to the application of furniture finishes. This bleaching helps to remove dark streaks from wood, provide more uniform color, obtain lighter colors while retaining all grain character, and control color from one batch of furniture to another. Contact Advertising Dept., Binks Manufacturing Co., 9201 W. Belmont Ave., Franklin Park, IL 60131, for more complete information on the Model 102-310 Mavrick Bleaching Gun.

Products Bulletin

A six-page brochure tracing the physical and chemical properties of products for the coatings industry has been released. Principal uses are also covered in an extensive, fold-out chart. Contact Hercules Incorporated, Product Information, Hercules Plaza, Wilmington, DE 19894, for a copy of "Resins, Fatty Acids, and Terpenes for the Coatings Industry."

Acrylic Latexes

A 12-page booklet describing two new specialty acrylic polymers designed for hard, block-resistant floor paints and sealers, has been issued. The new latexes are designed to provide alkali resistance, wet adhesion, and development of hardness. Adhesion to wood and resistance to grain cracking are also shown by performance data on floor paints formulated with the new latexes. Copies of the booklet, "UCAR® Latex 421 and 422," designated F-60723, are available from Union Carbide Corp., UCAR Emulsion Systems, Dept. L4488, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Accelerated Weathering Apparatus

The introduction of a laboratory test chamber that automatically cycles test specimens through immersion, vapor phase, and high temperature/ultraviolet light exposures has appeared in literature. Rusting, chalking, blistering, cracking, and peeling failures have been duplicated. For more information on the KTA Envirotest® accelerated weathering apparatus, contact KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15272.

Scanning Electron Microscope

Technical data is available on a scanning electron microscope (SEM) cinematography system. A key feature of this system is its digital frame store. It allows users to see on a monitor exactly what the SEM is seeing, with no noise on slow scan and without having to take photomicrographs or Polaroid™ shots. Contact Electron Optics Div., Carl Zeiss, Inc., One Zeiss Dr., Thornwood, NY 10594, for more information on the DSM 960 scanning electron microscope.

EnBA Resins

A new line of ethylene n-butyl acrylate (EnBA) resins for use in compounding hot melt adhesives is the topic of recently released literature. These resins are designed to meet the requirements of FDA regulation 21 CFR Section 175.105 pertaining to packaging adhesives for in-direct contact with food. Send inquiries regarding Enathene™ EnBA resins to, Henry D. Gudrian, Director/Communications, Quantum Chemical Corp., USI Div., 11501 Northlake Dr., Cincinnati, OH 45249.

Viscosity Cups

A new series of aluminum metal viscosity cups with removable stainless steel orifices, which measure the consistency of liquid materials such as paint, lacquer, adhesives, etc., has been previewed in a technical brochure. A copy of the descriptive literature on Gardner/ISO Cups is available from Paul N. Gardner, Sr., Paul N. Gardner Co., Inc., 316 N.E. First St., Pompano Beach, FL 33060.

Microporous PTFE Film

A microporous polytetrafluorethene (PTFE) film for use in industrial and laboratory filtration is the subject of recently released literature. The product combines the inert, nonadhering, water-repellent properties of PTFE, with a tightly controlled pore size, which can be varied. Write to Dr. T. Thomas, Mupor Ltd., P.O. Box 35, Parkview Industrial Estate, Brenda Rd., Hartlepool, Cleveland TS25 1NL England, for more information on Mupor Microporous PTFE Film.

Fixed-Mount Mixers

A two-page, two-color brochure describing the features of gear-driven and direct-driven fixed mounted mixers has been issued. The bulletin lists mixer specifications, including weight and dimensions. Sizes range from .30 to 3.5 hp. For a copy of the brochure "10 Reasons to Make it a Lightnin® Fixed Mounted Mixer for Open Tanks," designated B-578, write to Maude Hall, Mixing Equipment Co., 221 Rochester St., P.O. Box 190, Avon, NY 14414.

Cleaning System

A cleaning system that uses dry ice particles to safely remove paint, grease, adhesives, epoxies, baked food, and other contaminants is the subject of new literature. The system is available either as a stationary or mobile unit. For more information on the Cold Jet® system, request Form #6834 from Liquid Carbonic, Advertising Dept., 135 S. LaSalle St., Chicago, IL 60603.

Water Solutions Filtration

A 24-page filter catalog is now available in a revised and updated version. This book can be used in any machine shop using wet sanders, saws, grinding machines, EDM systems, water blast processes, deburring and honing, and lapping machines. For a copy of the 1989-90 "Filter Book," write to Industrial Filters Co., Box 823, Fairfield, NJ 07006.

Reactive Diluent

A new reactive diluent for aqueous industrial baking coatings, has been introduced in literature. It is designed to increase solids and reduce the viscosity of crosslinked coatings, resulting in VOC reductions of 0.5 lb/gal or more. The new reactive diluent reportedly can be used as a modifier to help achieve VOC compliance for automotive, appliance, metal furniture, and coil coatings. Further information on UCAR® Reactive Diluent RD 65-2, can be obtained from Union Carbide Corp., Solvents and Coatings Materials Div., Dept. L4488, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Fluorescence LC Detector

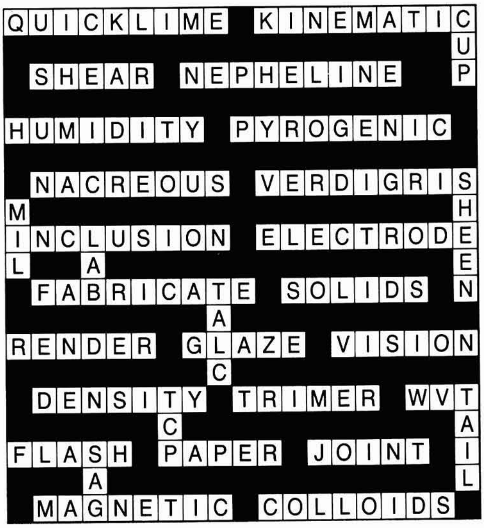
A sensitive, programmable fluorescence LC detector that combines fluorescence, phosphorescence, chemiluminescence, and bioluminescence capabilities in one instrument has been introduced. Using the product's fluorescence detection capability, compounds reportedly can be detected down to the femtogram level, while its phosphorescence and chemiluminescence capabilities substantially increase the power of the technique. Further technical information on the Model LS-40, can be obtained by contacting The Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0012.

Production Attritors

The availability of a 12-page, two-color brochure featuring a complete line of production attritors has been announced. Included are detailed descriptions and technical specifications on batch attritors for wet grinding; batch attritors for processing tungsten carbide; attritors for dry grinding in batch and continuous processes; circulation attritors for narrow particle size distribution; and continuous attritors for in-line processing. For a free copy of the production attritors brochure, contact Union Process, Inc., 1925 Akron-Peninsula Rd., Akron, OH 44313.

Industrial and Marine Coatings

Designed for use by industrial plant maintenance crews and industrial flooring and contractors, this six-page, four-color brochure describes particular coatings for common industrial areas such as loading docks, boiler rooms, clean rooms, etc., and for specific end-use application including waste treatment plants, food processing facilities, heavy duty manufacturing environments, and other industrial areas. All inquiries for additional formation should be identified as, "Floor Systems and Specialty Coatings for Industrial and Marine Applications," and sent to Sherwin-Williams Stores Group, c/o Robert Silverman Co., 1375 Euclid Ave., Cleveland, OH 44115.



Solution to August's *"CrossLinks"*

Molded Relief Valves

A two-color catalog which describes and illustrates molded, angle, and in-line pattern relief valves designed for use with corrosive and ultra-pure liquid applications has been released. Detailed information is provided on U-cup and rolling diaphragm models intended to solve aggressive chemical or crystallization problems. For a copy of the "Chemical Resistant Relief Valves Catalog RV," contact Plast-O-Matic Valves, Inc., 430 Route 46, Totowa, NJ 07512.

Toroidal X-Ray Monochromator

Technical data is obtainable on a toroidal x-ray monochromator. The x-ray monochromator is based on a 500 mm Rowland circle geometry using a toroidal crystal surface. It is designed to provide a narrow x-ray energy distribution resulting in high energy resolution of the photoemission peaks with sharp line widths and enhanced spectral detail. For further information on the Model 10-410 toroidal x-ray monochromator, contact Physical Electronics, 6509 Flying Cloud Dr., Eden Prairie, MN 55344.

Filter Product Line

A 16-page, full-color product catalog describing a filter product line has been issued. The brochure features photomicrographs which clearly show the interior construction of this filter. In addition, applications, features, and benefits are presented in tabular form. To receive a free copy of the new Profile® II Filter Catalog, designated Bulletin PRO 400, contact Pall Process Filtration, Co., 2200 Northern Blvd., East Hills, NY 11548.

Repair Videotape

A detailed, step-by-step instructional videotape for the repair of mixers up to 600 hp has been introduced. The entire repair process, from preparation for disassembly to lubrication prior to start-up, is covered. For more information on how to acquire the video "Repair and Assembly of Lightnin® 780/880 Series Speed Reducers," write to Mixing Equipment Co., 135 Mt. Read Blvd., Rochester, NY 14603.

Color Analyzer

The introduction of a color analyzer that also functions as an IBM-compatible personal computer has been announced in literature. The system features an internal 20MB hard disk drive capable of storing more than 10,000 color standards and a 3.5 inch floppy disk access for storage and back-up of files on the hard disk. Further data on the Color Mate™ HDS color analyzer can be obtained by contacting Milton Roy, 820 Linden Ave., Rochester, NY 14625.

Liquid Membrane

A four-page technical brochure which includes a variety of application photos on a liquid applied waterproofing membrane has been released. Graphic charts list specific technical data, and illustrations are used to display the application process clearly and quickly. Write to Gaco Western, Inc., P.O. Box 88698, Seattle, WA 98138, for a copy of the brochure designated LM-60.

Ultrahigh Vacuum

A catalog providing 168 pages of detailed information on a complete line of vacuum products has been introduced. Included in the catalog are systems and chambers, ion pumps and controls, measurement instruments, valves, roughing devices, flanges, fittings, and feedthroughs. For a free copy of the "PHI Ultrahigh Vacuum Equipment Catalog for 1989/90," write to Physical Electronics, 6509 Flying Cloud Dr., Eden Prairie, MN 55344.

PE/PET Packaging Films

Problems in layers of polyethylene terephthalate (PET) and polyethylene (PE) films which can contribute to poor overall performance in packaging, is the topic of recently released literature. The two-page bulletin focuses on heat-sealing, moisture, permeability, and durability problems that may occur and suggests that dynamic mechanical analysis may help solve these problems. The brochure, "Dynamic Mechanical Properties of PE and PET Packaging Films" (Application Bulletin No. 16), is available by contacting the Marketing Department of Rheometrics, Inc., One Possumtown Rd., Piscataway, NJ 08854.

Corrosion-Resistant Film

A chromate conversion process for aluminum and its alloys which produces a golden-yellow film with corrosion resistance and paint-adhesion properties has been introduced in technical literature. The film conforms to DEF STAN 03-18/1 and MIL-C-5541 specifications for chemical films for aluminum and aluminum alloys. For more information on Alucoat corrosion-resistant chemical film, write to C. Jones, PMD Chemicals Ltd., Broad Lane, Coventry CV5 7AY, England.

Heat-Seal Adhesives

A new series of UV-curable heat-seal products is the subject of literature. Applications for the heat-seal adhesives includes blister coatings, dual function high gloss carton coating/sealing adhesive, laminating, etc. More details on the 100 Series UV Heat-Seal Adhesives are available from Rad-Cure Corp., 112 Naylon Ave., Livingston, NJ 07039.

Degassing Unit

A new multi-port degassing unit which is designed to degas up to three samples simultaneously and independently is the focus of a data bulletin. The degassing unit includes three port-specific detectors and has the ability to track the desorption of impurities. Data on DeSorb 2300B is available from Micromeritics, One Micromeritics Dr., Norcross, GA 30093-1877.

Rotating Electrode

A system with ultra-high sensitivity for trace metals analysis is described in literature. Sensitivity is achieved through stripping voltammetry with a rotating thin film electrode. Details on the Voltammetric Analysis System can be obtained by writing EG&G Princeton Applied Research, Electrochemical Instruments Div., CN 5206, Princeton, NJ 08543-5206.

Liquid Purification Systems

A four-page brochure detailing a variety of liquid phase treatment systems is now available. The bulletin provides application information and photographs of a number of pre-engineered and custom systems designed to remove soluble and volatile organic chemical compounds from water, wastewater, chemicals, petrochemicals, foods, and pharmaceuticals. For a free copy of "Liquid Purification Systems & Services," write to Calgon Carbon Corp., P.O. Box 717, Pittsburgh, PA 15230-0717.

Coalescing Solvents

A technical bulletin highlights two new propylene-oxide based solvents designed for architectural and industrial water-borne coatings. The solvents are colorless, have evaporation rates less than one, and can be used with a variety of latex vehicles. For further information on Butyl and Propyl Dipropasol®, write Union Carbide Corp., Solvents and Coatings Materials Div., Dept. L4488, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Aqueous Rosin Dispersions

The typical properties and uses of aqueous rosin dispersions used in adhesives, coatings, and binders are discussed and charted in a four-page brochure. A chart cites properties for unmodified, polymerized, and hydrogenated rosin forms. For a copy of "Dresinol/Aqueous Dispersions," write Hercules Incorporated, Product Information, Hercules Plaza, Wilmington, DE 19894.

Liquid Packaging System

A product sheet highlights a new, fully-automatic, one gallon liquid packaging system which includes a filler, high-speed metal friction lid placer, and high-speed check weigher. The system is capable of filling and sealing 30-50 containers per minute from four fill positions. Write Ambrose Co., 2649—151st Place, N.E., Redmond, WA 98052 for details on the Series 900 system.

Small Media Mills

A technical bulletin introduces a new series of production size mills designed to produce fines from solid particles in any type of solvent or aqueous system. A universal cast frame allows capacity upgrades from 15 to 60 liters and a patent cartridge media separator allows small media size down to 0.25 mm. For additional information on the LMC Series mills, write Netzsch Inc., 119 Pickering Way, Exton, PA 19341-1393.

Servomotors and Amplifiers

A new series of servometers and amplifiers is the focus of information provided by product literature. The series servo systems feature continuous torque ratings from 19 to 1030 lb in., speeds to 5000 rpm, and peak power ratings up to 8 KVA. For more details about the Goldline Series servo systems, contact Nancy Burke, Industrial Drives, 201 Rock Rd., Radford, VA 24141.

Piston Pumps

A product data sheet introduces new 40-60 GPM reciprocating piston pumps which utilize a four ball check system. The pumps are designed for light to medium viscosity fluids and are offered in one hydraulic model and two air-powered models. For more data on the SuperVolume Pumps, write Advertising Dept., Binks Manufacturing Co., 9201 W. Belmont Ave., Franklin Park, IL 60131.

Exterior Stain

A line of both solid color and semi-transparent exterior stains is the subject of a product bulletin. The line has been expanded from 21 to 42 standard colors and can be custom tinted to over 300 colors. Product applications include siding, shakes, fences, and decorative wood. All inquiries for information on the Solid Color and Semi-Transparent Exterior Stain should be sent to Sherwin-Williams Stores Group, c/o Robert Silverman Co., 1375 Euclid Ave., Cleveland, OH 44115.

Computer Color Technology

The Spring 1989 issue of a newsletter dedicated to topics of interest in computer color technology has been published. The four-page publication describes recently introduced systems and software for computer color matching and quality control, and educational services training products. To obtain a copy of *Prismatics,* write Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543.

Water-Base Coating

A product data sheet describes a black, low-gloss water reducible primer which may be applied by either spray, dip, or flow-coat methods. The water-base coating dries in five minutes when applied to warm surfaces and has a 250-1000 hours salt-spray resistance based on .8 mil-1.0 mil dry film thickness. For a copy of the data sheet, write Jamestown Paint & Varnish Co., 108 Main St., Jamestown, PA 16134-9990.

Book Review

DISPERSING POWDERS IN LIQUIDS

By
Ralph D. Nelson

Published by
Elsevier Science Publishing Co., Inc.
P.O. Box 882
Madison Square Station
New York, NY 10159 (1988)
xviii + 246 Pages, $84.25

Reviewed by
Maurice J. McDowell
Consultant
Media, PA

This book achieves the author's goal of helping the reader "to understand the factors that cause agglomeration and dispersion in a slurry and to provide some guidance for selecting and optimizing the dosage of a surfactant that will provide a stable dispersion of a specific powder in a specific liquid."

The book contains information on the following topics: particle structure and physics; surface chemistry and thermodynamics; agglomeration; dispersant selection; and slurry tests and analyses. The appendices include properties of solids, liquids, and surfactants; surfactant manufacturers; and units, constants, and symbols.

The author wrote the book from a set of course notes which he had used in teaching slurry technology and powder dispersion. The book seems to be designed more for scientists employed by pigment or dispersant suppliers than for experienced formulators of inks or paints. The latter may need to know more about longer term stability of mixtures of several pigments, polymers, and dispersants. The author seems to recognize this in his statement on page 168—"Very few dispersants will pass all the tests for a complex system such as a paint." Many dispersants are not stable enough for long periods even at room temperature; yet data or references are not given. The author does however warn that "Organic sulfates and esters decompose by hydrolysis . . ." and "polyphosphates degrade through hydrolysis and are not recommended if the dispersion must be stable for more than a few days."

Another omission from this book which was the very broad title "Dispersing Powders in Liquids" is a section on dispersion equipment such as attritors, sand grinders, high speed dispersers, ball mills, etc.

There are several errors in spelling, punctuation, and grammar which are surprising when so many good word processing programs are available.

Despite these minor limitations this is an excellent book which could be considered along with Temple Patton's book "Paint Flow and Pigment Dispersion" as textbooks in courses on Applied Colloid Science.

Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact FSCT, 1315 Walnut St., Philadelphia, PA 19107 (215-545-1506).

1989

(Nov. 8-10)—67th Annual Meeting and 54th Paint Industries' Show. New Orleans Hilton and The Rivergate, New Orleans, LA.

1990

(Apr. 25-26)—Symposium on Color and Appearance Instrumentation (SCAI). Sponsored by the FSCT and the Inter-Society Color Council. Cleveland Airport Marriott, Cleveland, OH.

(Oct. 29-31)—68th Annual Meeting and 55th Paint Industries' Show. Convention Center, Washington, D.C.

1991

(Nov. 4-6)—69th Annual Meeting and 56th Paint Industries' Show. Convention Center, Toronto, Ontario, Canada.

SPECIAL SOCIETY MEETINGS

1990

(Feb. 21-23)—Southern Society. 17th Annual Water-Borne and Higher-Solids Coatings Symposium. New Orleans, LA. (Dr. Robson F. Storey, Department of Polymer Science, University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Mar. 14-16)—Southwestern Paint Convention. Houston and Dallas Societies. Doubletree at Post Oak, Houston, TX. (Neil McBride, P.O. Box 841156, Houston, TX 77284-1156).

(Apr. 4-7)—Southern Society. Annual Meeting. Sandestin Beach Hilton, Destin, FL. (James R. Salisbury, Union Carbide Corp., 2043 Steel Dr., Tucker, GA 30084).

1991

(Feb. 18-20)—Western Coatings Societies' 20th Biennial Symposium and Show. San Francisco Hilton, San Francisco, CA.

OTHER ORGANIZATIONS

1989

(Sept. 14-15)—"Waste Treatment Simplified." Course sponsored by the American Electroplaters and Surface Finishers Society. Ramada Inn Chandler, Chandler, AZ. (Sylvia L. Baxley, AESF, Central Florida Research Park, 12644 Research Parkway, Orlando, FL 32826).

(Sept. 18-22)—"Electroplating and Surface Finishing." Training course sponsored by the American Electroplaters and Surface Finishers Society. Ramada Inn Oakbrook 3, Elmhurst, IL. (Sylvia L. Baxley, AESF, Central Florida Research Park, 12644 Research Parkway, Orlando, FL 32826).

(Sept. 19-22)—Eurocoat 89 and 18th Congress of Association Francaise des Technicians des Peintures, Vernis, Encres d'Imprimerie, Colles et Adhesifs. Acropolis, Nice, France. (Mr. Jacques Roire, A.F.T.P.V., 5 rue Etex, 75018 Paris, France).

(Sept. 23-28)—12th World Conferences on Non-Destructive Testing sponsored by the Dutch Non-Destructive Testing Society. RAI International Exhibition and Congress Center, Amsterdam, The Netherlands. (RAI International Exhibition and Congress Center, Europaplein, 1078 GZ, Amsterdam, The Netherlands).

(Sept. 25-27)—Third Annual Hazardous Materials Management Conference and Exhibition of Canada (HazMat/Canada '89). Harbour Castle Westin Conference Centre, Toronto, Ont., Canada. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E—Suite 408, Glen Ellyn, IL 60137-5835).

(Sept. 25-29)—"Electroplating and Surface Finishing for Electronic Applications." Course sponsored by the American Electroplaters and Surface Finishers Society. Sheraton University Center, Durham, NC. (Sylvia L. Baxley, AESF, Central Florida Research Park, 12644 Research Parkway, Orlando, FL 32826).

(Sept. 25-30)—American Chemical Society. 196th National Meeting. Los Angeles, CA. (B.R. Hodson, ACS, 1155—16th St. NW, Washington, D.C. 20036).

(Sept. 26-27)—Finishing '89. Telford Exhibition Center, Telford, Shropshire, England. (Nigel Bean, Turret Group Plc, Turret House, 171 High St., Rickmansworth, Herts, WD3 1SN).

(Sept. 26-28)—"Inspection of Coatings and Linings for Immersion Service" Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Sept. 27-29)—Liquitec Expo '89 (Carolyn Mesce, Liquitec Expo, P.O. Box 630, West Paterson, NJ 07424).

(Sept. 27-29)—Haztech International Fourth Annual Conference and Exhibition. San Francisco Civic Auditorium, San Francisco, CA. (Rachelle Scheinbach or Ursula Barril, Haztech International, 13555 Bel-Red Rd., C-96870, Bellevue, WA 98009).

(Oct. 1-7)—"Basic, Intermediate, and Advanced Coating Inspection." Courses sponsored by the National Association of Corrosion Engineers (NACE), Houston, TX. (NACE Education and Training, NACE, P.O. Box 218340, Houston, TX 77218).

(Oct. 3-4)—Coatings Industry Safety Seminar sponsored by the National Paint & Coatings Association (NPCA). Stouffer Concourse Hotel, St. Louis, MO. (Cheryl Matthews, NPCA, 1500 Rhode Island Ave., NW, Washington, D.C. 20005).

(Oct. 3-4)—"Painting Processes: Industrial Paint Application 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. 4-6)—"Chemistry and Properties of High Performance Composites: Designed Especially for Chemists." Short Course sponsored by the State University of New York (SUNY) at New Paltz. San Diego, CA. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Oct. 4-6)—National Coil Coaters Association (NCCA) Fall Meeting. Hyatt Regency at O'Hare Airport, Chicago, IL. (NCCA, 1900 Arch St., Philadelphia, PA 19103).

(Oct. 17-18)—Coatings Industry Safety Seminar sponsored by the National Paint & Coatings Association (NPCA). Philadelphia Airport Hilton Inn, Philadelphia, PA. (Cheryl Matthews, NPCA, 1500 Rhode Island Ave., NW, Washington, D.C. 20005).

(Oct. 17-20)—ASTM Committee B-8 Meeting on Metallic and Inorganic Coatings. ASTM Headquarters, Philadelphia, PA. (Peggy Loughran, ASTM, 1916 Race St., Philadelphia, PA 19103).

(Oct. 21-26)—61st Annual Meeting of the Society of Rheology in conjunction with the First Annual Meeting of the Canadian Rheology Group and First Inter-American Conference on Rheology. Grand Hotel, Montreal, Que., Canada. (L.A. Utracki, Program Chairman, NRCC/IMRI, 75 boul. de Mortagne, Boucherville, Que., Canada J4B 6Y4).

(Oct. 22-27)—"Protective Coatings and Linings." Course sponsored by the National Association of Corrosion Engineers (NACE), Houston, TX. (NACE Education and Training, NACE, P.O. Box 218340, Houston, TX 77218).

(Oct. 23-25)—"High-Coatings." 9th International Conference of the Paint Research Association. Sheraton Hotel, Frankfurt, West Germany. (Dip Dasgupta, Head of Information Dept., PRA, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD, England).

(Oct. 23-25)—"Fundamentals of Adhesion: Theory, Practice, and Applications." Short Course sponsored by the State University of New York (SUNY) at New Paltz. Pearl River (New York City), NY. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Oct. 23-25)—"High Performance Polymers: Chemistry, Properties, and Applications." Short Course sponsored by the State University of New York (SUNY) at New Paltz. Pearl River (New York City), NY. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Oct. 23-25)—"Total Statistical Process Control 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. 24-26)—8th International Conference on the Internal and External Protection of Pipes. Cosponsored by BHRA and Snamprogetti. Florence, Italy. (Conference Organizer (Pipe Protection), BHRA, The Fluid Engineering Centre, Cranfield, Bedford MK43 OAJ, England).

(Oct. 31-Nov. 2)—"Maintenance/Industrial Painting Practices" Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Nov. 1-2)—"Paint Volatile Organic Compounds (VOC)" Workshop sponsored by ASTM Standards Technology Training. ASTM Headquarters, Philadelphia, PA. (Kathy Dickinson, ASTM Standards Technology Training, 1916 Race St., Philadelphia, PA 19103).

(Nov. 5-11)—"Basic and Intermediate Coating Inspection." Courses sponsored by the National Association of Corrosion Engineers (NACE), Vancouver, B.C., Canada. (NACE Education and Training, NACE, P.O. Box 218340, Houston, TX 77218).

(Nov. 6-7)—25th Annual Symposium of ASTM Committee G-1. Orlando, FL. (Symposium Chairman Robert Baboian, Texas Instruments, Inc., Electrochemical and Corrosion Laboratory, Mail Station 10-13, Attleboro, MA 02703, or Sheldon W. Dean, Jr., Air Products and Chemicals, Inc., P.O. Box 538, Allentown, PA 18105).

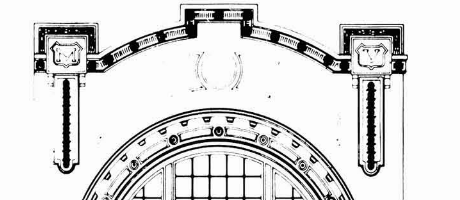
(Nov. 6-8)—National Paint & Coatings Association Annual Meeting. New Orleans Hilton Hotel, New Orleans, LA. (NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Nov. 6-9)—10th Biennial "Managing Corrosion with Plastics" Symposium. Sponsored by the National Association of Corrosion Engineers (NACE), AIChE, ASCE, SPE, SPI, SPI-Canada, and TAPPI, San Antonio, TX. (NACE Education and Training, NACE, P.O. Box 218340, Houston, TX 77218).

(Nov. 7-9)—Hazardous Materials Management West Conference and Exhibition. Long Beach Convention Center, Long Beach, CA. (Brenda O'Neal, Show Manager, Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E—Suite 408, Glen Ellyn, IL 60137-5835).

(Nov. 12-18)—"Basic, Intermediate, and Advanced Coating Inspection." Courses sponsored by the National Association of Corrosion Engineers (NACE), New Orleans, LA. (NACE Education and Training, NACE, P.O. Box 218340, Houston, TX 77218).

(Nov. 18-20)—National Decorating Products Show sponsored by the National Decorating Products Association. McCormick Place, Chicago, IL. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).



(Nov. 26-Dec. 1)—"Protective Coatings and Linings." Course *sponsored* by NACE, ICorrST, and CEA, Berkshire, England. (CEA Education Courses, 174 High St., Guildford, Surrey, GU1 3HW).

(Nov. 27-30)—"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).

(Nov. 28-30)—"Level II—*Industrial Maintenance Course*" sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, 115 Technology Dr., Pittsburgh, PA 15275).

(Nov. 28-Dec. 1)—The Inter-Society Color Council Williamsburg Conference. Williamsburg, VA. (Roy Berns, Rochester Institute of Technology, P.O. Box 9887, Rochester, NY 14623-0887).

(Dec. 3-8)—SSPC 89. National Conference and Exhibition sponsored by the Steel Structures Painting Council (SSPC). George R. Brown Convention Center, Houston, TX. (Rose Mary Surgent, Meetings Manager, SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213).

(Dec. 3-9)—"Basic and Advanced Coating Inspection." Courses sponsored by the National Association of Corrosion Engineers (NACE), Houston, TX. (NACE Education and Training, NACE, P.O. Box 218340, Houston, TX 77218).

(Dec. 4-8)—"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).

(Dec. 9-10)—"Advances in Surface Coatings and Their Applications." National Seminar sponsored by the Oil Technologists' Association of India (Central Zone), Harcourt Butler Technological Institute, Kanpur. (S. Chandra, Convener, Seminar, Oil Technologists' Association of India (C.Z.), H.B. Technological Institute, Kanpur-208 002).

1990

(Feb. 18-21)—Adhesion Society Annual Meeting. Sheraton Savannah Resort and Hotel, Savannah, GA. (Adhesion Society President Jim Wightman, Dept. of Chemistry, VPI & SU, Blacksburg, VA 20461).

(Mar. 13-15)—Electrocoat/90. Drawbridge Inn and Convention Center, Ft. Mitchell, KY. (Cindy Puthoff or Anne Goyer, Gardner Management Services, 6600 Clough Pike, Cincinnati, OH 45244).

(Mar. 25-29)—RadTech '90—North America. Radiation Curing Conference and Exposition. Hyatt Regency Chicago, Chicago, IL. (RadTech International North America, 60 Revere Dr., Suite 500, Northbrook, IL 60062).

(Apr. 2-6)—11th International Corrosion Congress. Florence, Italy. (AIM—*Associazione Italiana di Metallurgia, Piazzale Rodolfo* Morandi, 2, I-20121 Milano, Italy).

(Apr. 22-24)—Inter-Society Color Council Annual Meeting. Cleveland Airport Marriott, Cleveland, OH. (Program Chairman, James E. Grady, Pigments Dept., CIBA-GEIGY Corp., 7187 White Pine Dr., Birmingham, MI 48010).

(May 2-9)—Surface Treatment '90. Hannover Fairgrounds, Hannover, West Germany. (Hannover Fairs USA Inc., 103 Carnegie Center, Princeton, NJ 08540).

(May 14-15)—"Analysis of Paints and Related Materials." Symposium sponsored by ASTM Committee D-1. Pittsburgh, PA. (Marsha Firman, ASTM, 1916 Race St., Philadelphia, PA 19103).

(June 18-20)—64th American Chemical Society (ACS) "Colloid and Surface Science" Symposium. Sponsored by ACS Division of Colloid and Surface Chemistry, Lehigh University, Bethlehem, PA. (M.S. El-Aasser, Emulsion Polymers Institute, Lehigh Univ., 111 Research Dr., Bethlehem, PA 18015).

Advertisers Index

'Humbug' from Hillman

Earl Hill, known to "CrossLink" fans among our Journal readers, apparently is a computer hacker as well as a tantalizing word expert. Here are some recently patented inventions he found on his screen—as discovered by "The Humorous Hacker":

- Toilet lid lock (patent #3477070)—to prevent unauthorized access to toilet bowl.
- Whisper seat (patent #3593345). Toilet seat with acoustical liner to prevent sounds from being heard.
- Eyeglass frames with adjustable rear view mirrors (patent #3423150).
- Carry-all hat (patent #3496575). A hat with a cavity for carrying cosmetics, jewelry, and the like.
- Simulated firearm with pivot-mounted whiskey glass (patent #3450403)—pulling the trigger pivots the glass towards a person's mouth.
- Electronic snore depressor (patent #3552388). Snore is detected and the snorer is electrically shocked.

The Hacker and Earl were also responsible for finding the following startling and invaluable facts:

When ill, Ethiopian Emperor Menelik would eat a few pages of the Bible to restore his health. Unfortunately, he died in 1913 after eating the entire Book of Kings.

Quick as a wink (1/10th second) is faster than you can say Jack Robinson (1/2 second).

The U.S. Post Office spent $3.4 million on an advertising campaign to encourage Americans to write more letters to one another despite the fact that all classes of mail, including first class, are operating at a financial loss. It then spent $775,000 to test the results of the campaign.

In one of the biggest bank thefts in history, computer analyst Mark Rifkin used the services of a computer to transfer $10.2 million from the Security Pacific Bank in Los Angeles to an account in Switzerland. Unable to keep the amazing feat to himself, Rifkin made several remarks to a businessman, who called the FBI. He was arrested on November 5, 1978. While out on bail, Rifkin attempted a second illegal wire transfer of $50 million and was rearrested in March 1979. He was convicted and sentenced to eight years in prison. The computer was not prosecuted.

Joe Boatwright has rediscovered Richard Lederer, many of whose "student bloopers" were published in "Humbug" in earlier columns. Lederer swears that these are certifiably genuine and were collected by teachers from eighth grade to college level. Funny?—or Sad!!!

—Socrates was a famous Greek teacher who went around giving people advice. They killed him. Socrates died from an overdose of wedlock. (*Humbug believes that this is a fairly common occurrence.)*

—Eventually, the Romans conquered the Greeks. History calls people Romans because they never stayed in one place very long. At Roman banquets, the guests wore garlics in their hair. Julius Caesar extinguished himself on the battlefields of Gaul. The Ides of March murdered him because they thought he was going to be made king. Nero was a cruel tyranny who would torture his poor subjects by playing the fiddle to them.

—The government of England was a limited mockery. Henry VIII found walking difficult because he had an abess on his knee. Queen Elizabeth was the "Virgin Queen." As a queen she was a success. When Elizabeth exposed herself before her troops, they all shouted "hurrah." Then her navy went out and defeated the Spanish Armadillo.

—Delegates from the original thirteen states formed the Contented Congress. Thomas Jefferson, a Virgin, and Benjamin Franklin were two singers of the Declaration of Independence. . . . Franklin died in 1790 and is still dead.

—Abraham Lincoln became America's greatest Precedent. Lincoln's mother died in infancy and he was born in a log cabin which he built with his own hands. When Lincoln was Precedent, he wore only a tall silk hat. . . . Abraham Lincoln wrote the Gettysburg Address while traveling from Washington to Gettysburg on the back of an envelope. . . . The Fourteenth Amendment gave the ex-Negroes citizenship. . . . On the night of April 14, 1865, Lincoln went to the theater and got shot in his seat by one of the actors in a moving picture show. The believed assinator was John Wilkes Booth, a supposingly insane actor. This ruined Booth's career.

—Meanwhile in Europe, the enlightenment was a reasonable time. Voltare wrote a book called CANDY. Gravity was invented by Isaac Walton. It is chiefly noticeable in the Autumn, when the apples are falling from the trees.

—Bach was the most famous composer in the world, and so was Handel. Handel was half German, half Italian, and half English. Bach died from 1750 to the present. Beethoven wrote music even though he was deaf. He was so deaf he wrote loud music. . . . Beethoven died in 1827 and later died for this.

—The sun never set on the British Empire because the British Empire is in the East and the sun sets in the West. Queen Victoria was the longest queen. She sat on a thorn for 63 years. Her reclining years and finally the end of her life were exemplatory of a great personality. Her death was the final event which ended her reign.

There's more, but enough is enough—for now!!

—Herb Hillman
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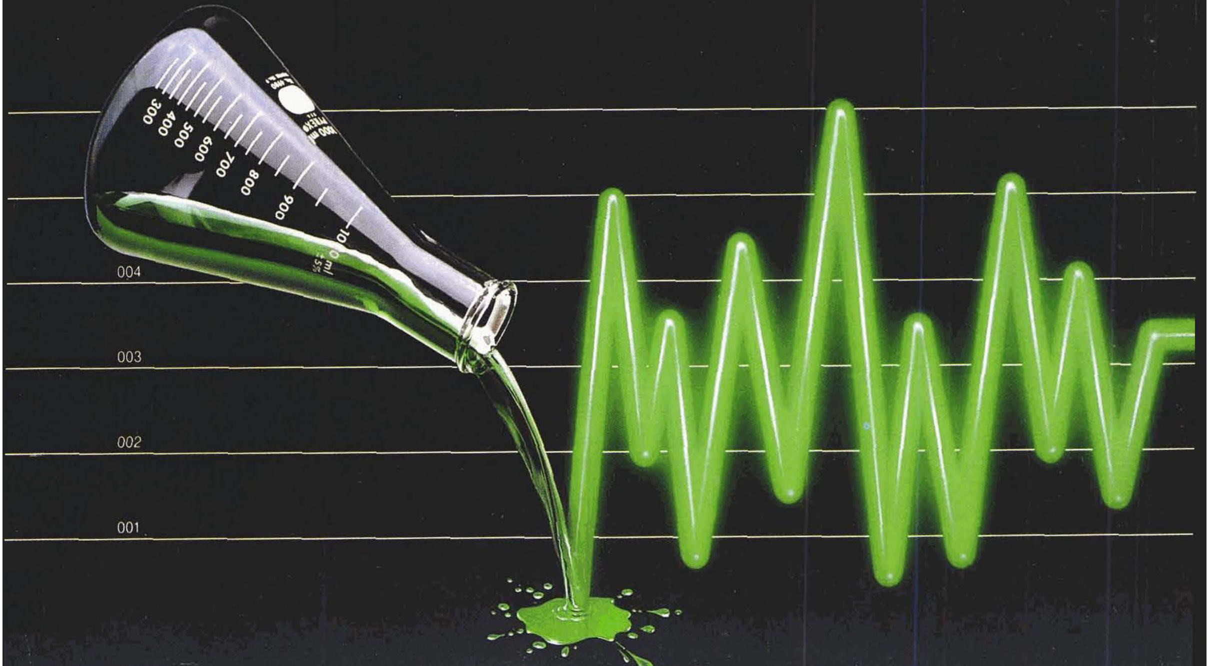
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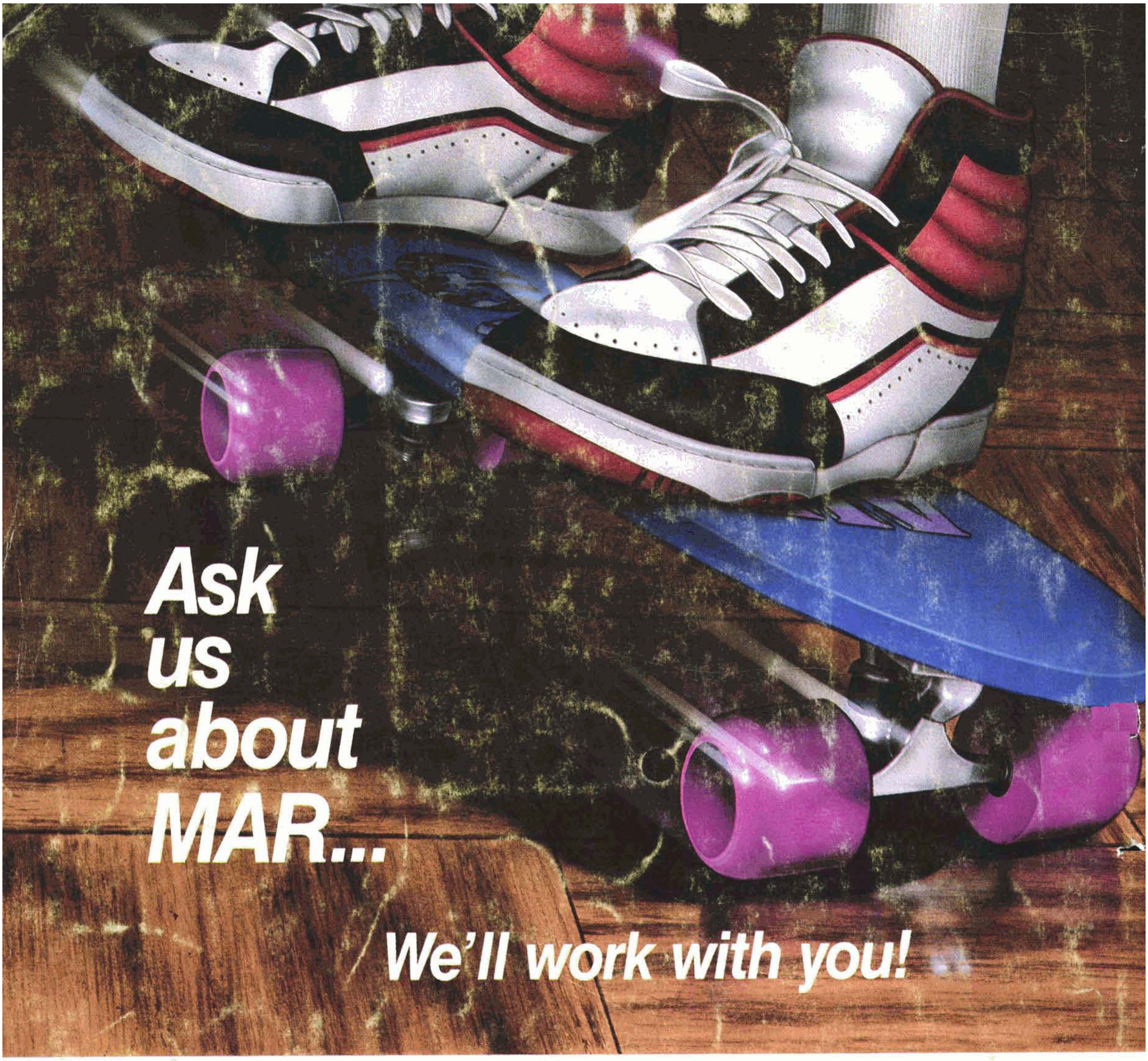
Ask
us
about
MAR...
We'll work with you!