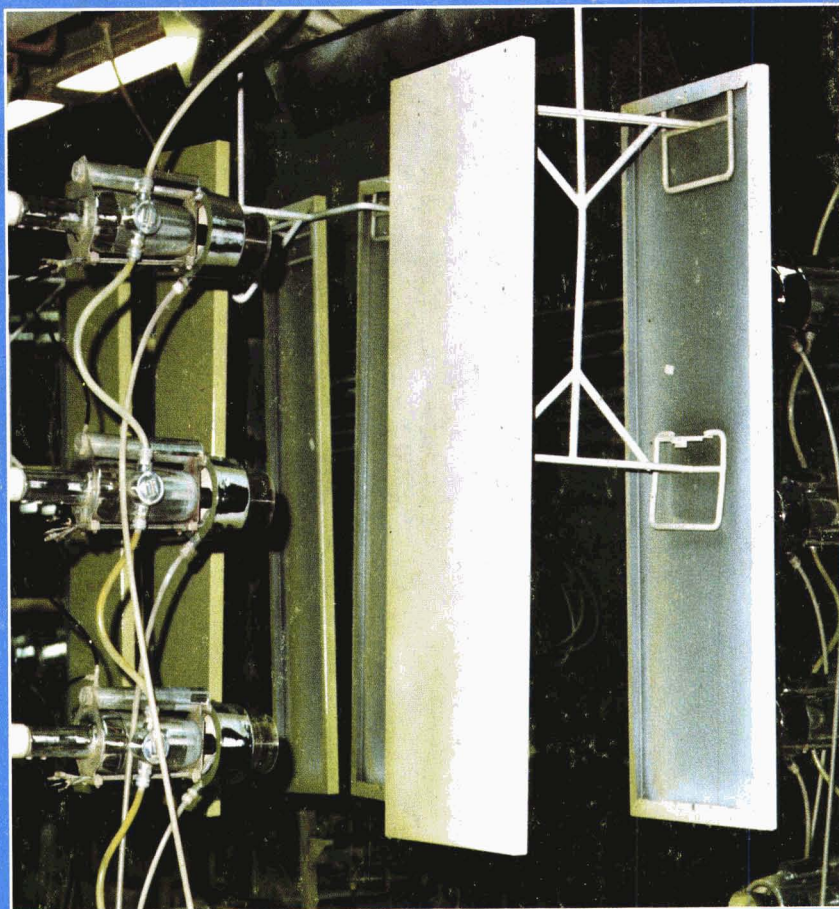


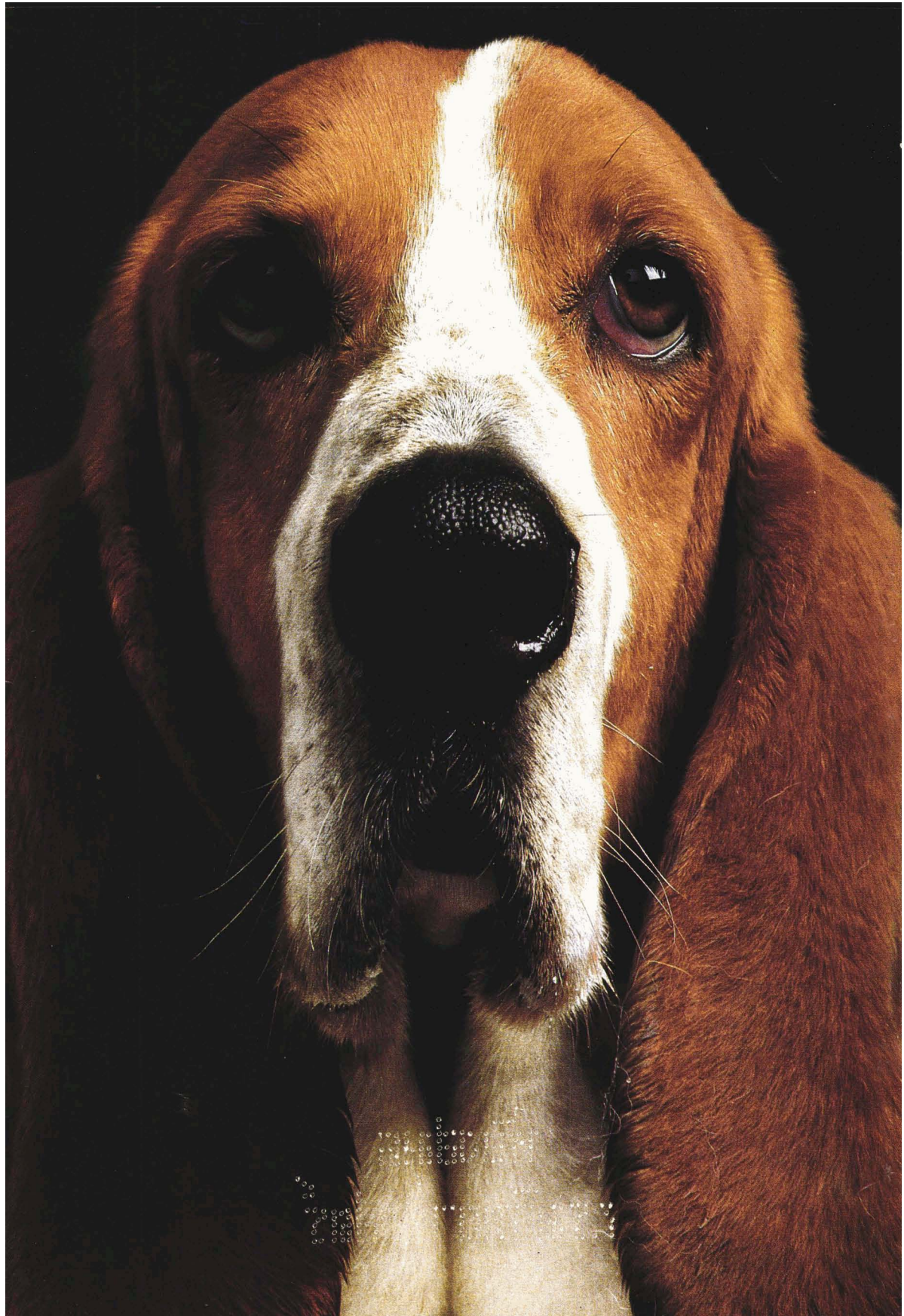
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THE JOURNAL OF COATINGS TECHNOLOGY (ISSN 0361-8773) is published monthly by the Federation of Societies for Coatings Technology, 1315 Walnut St., Philadelphia, PA 19107. Phone: (215) 545-1507. Second class postage paid at Philadelphia, PA and at additional 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, Mich. 48106.

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

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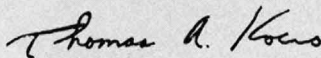
For Aerosols and Water-Bornes, Microgels and Toxic Regs—McCormick's the Place

The Federation Annual Meeting and Paint Industries' Show returns to Chicagoland next month, presenting a smorgasbord of technical attractions to whet the appetites of coatings personnel.

The three days of program sessions (see pages 22-27) cover a wide variety of coatings topics, keyed to the theme of "Performance *and* Compliance: The Challenge Intensifies." From the theoretical to the practical, Chairman Rick Hille and his Program Committee have scheduled a plentiful supply of offerings that should have much appeal for a goodly cross-section of the industry.

Complementing the program presentations are the exhibits of 235 supplier firms, whose displays of new products, applications, and services will fill all available booth space in the Paint Show, making this year's event the largest ever.

The lineup of attractions awaiting registrants at McCormick Place offers an exceptional opportunity for technical updating. So, if you haven't already done so, make your plans now to be in Chicago October 19-21 for the Major Coatings Event of 1988!



THOMAS A. KOCIS,
CONTRIBUTING EDITOR

John Massingill helped a
contract. Yet he still needs help



can coater keep a \$1 million matching his ties and shirts.



There are two things about John Massingill that people soon learn. He is a very good chemist. And a very bad dresser. It's gotten to the point around the Massingill home that his wife labels which ties go with which shirt—which is a pretty good solution since most colors appear alike to John's eyes. (The blue tie goes with the yellow shirt in the photo at left.)

Fortunately, fancy ties are not in fashion in the Dow lab where John works—but creative chemistry is. Here John excels.

A few months ago, for example, John helped a Dow customer hold onto a one million dollar can coating contract when its customer put on the squeeze. The problem: The resin viscosity range had to be cut in half while all other performance characteristics had to remain the same.

"It sounds simple," says John. "But it took weeks to work out the details. At one point we had six functions at Dow involved—from research to marketing to production. We ran the Freeport, Texas plant around the clock for five days during production. We virtually customized the resin, but it finally helped our customer out of a tight jam?"

John is just one of the more than 150 people in Dow's Resin Products coatings group working with coating formulators and makers of can coatings like yours.

In the coming months, you will see more of John and his colleagues—visiting labs, attending trade shows and delivering papers at conferences. Wherever you see them, they are there to answer your questions, listen to your needs and respond with products and technical insights.

If you'd like, you can call John right now to discuss your technical needs in epoxy resins for can coatings. Just call toll-free 1-800-258-2436, ext. 21, Coatings, or send in the coupon below.

Oh yes, and please feel free to suggest some clothing ensembles for John—his family is running out of ideas.

To: The Dow Chemical Company, Resin Products Department, P.O. Box 1206, Midland, MI 48641-9940 J988

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Abstracts of Papers in This Issue

POLYURETHANE OLIGOMERS FOR WATER-BORNE AND HIGH SOLIDS COATINGS—W.J. Blank

Journal of Coatings Technology, 60, No. 764, 43 (Sept. 1988)

Properly designed polyurethane oligomers offer a combination of properties including high hydrolytic stability, excellent exterior durability, hardness, and flexibility not obtained with other polymers. We have prepared a polyurethane oligomer which is soluble in a wide range of polar solvents and in water, while being compatible with acrylic, polyester, and amino high solids resins. The advantages of using a low molecular weight urethane oligomer as a polymer modifier are increased application solids, higher film hardness, and, for some systems, improved flexibility. The properties of this oligomer in water-borne and high solids coatings as a modifier for other polymer systems will be described.

COMPARISON OF VOLATILE ORGANIC CONTENT (VOC) AND VOLATILES RELEASED FROM A MELAMINE CROSSLINKED HIGH-SOLIDS POLYESTER—Northwestern Society

Journal of Coatings Technology, 60, No. 764, 51 (Sept. 1988)

Measurements of volatile organic compounds released when a melamine crosslinked polyester is cured at different temperatures were compared with those released using the EPA recommended procedure for volatile organic content (VOC). The data indicate that VOC should be measured at the application curing temperature since there is disagreement between the VOC determined at higher applied temperatures and the value based on the EPA procedure. This data will allow suppliers and users of coatings to compare coating materials on the same basis. The VOC at three cure temperatures (110, 149, and 205°C) varied from 275 to 363 g/L. Analytical techniques were employed to demonstrate that complex chemical reactions occur with the melamine cured systems as the temperature is increased, resulting in differences in the amounts of volatile materials released.

Paint Show Issues

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

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

A HIGH SOLIDS ONE-COMPONENT, LOW TEMPERATURE BAKE EPOXY COATING—M. Agostinho and V. Brytus

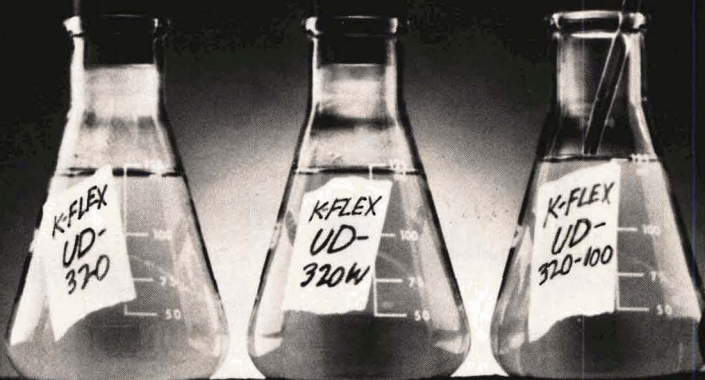
Journal of Coatings Technology, 60, No. 764, 61 (Sept. 1988)

A current challenge to suppliers and formulators is reducing the volatile organic compound (VOC) in coatings while maintaining low viscosity and good cure properties.

One approach to lowering the VOC has been to reduce the molecular weight of the polymer, which in turn reduces the viscosity of the system. This can result in a loss in physical properties of the coating.

A different approach involves the use of a solid latent hardener in combination with liquid epoxy resins, which cures through epoxy functionality. This has developed into a high solids epoxy coating possessing improved properties over existing primer systems and is the subject of this paper.

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ASTM Forms New Protective Coating Subcommittees; Participants Needed for New Scattering Group

The American Society for Testing and Materials (ASTM) Committee D-33 on Protective Coating and Lining Work for Power Generation Facilities has formed two new subcommittees: D33.12 on Coatings and Linings for Condensers and Heat Exchangers and D33.14 on Hazardous Wastes in Utility Protective Coating and Lining Work.

Subcommittee D33.12 is responsible for defining and describing corrosion and erosion problems in heat exchangers and steam condensers and providing guidance to owners and users in selecting and applying lining and coatings to solve those problems. In addition, documents developed will serve as a focal point for changing technology in the design and materials of new equipment and life extension of existing equipment.

The scope of Subcommittee D33.14 is to identify concerns and problems associated with generation and disposal of hazardous wastes in utility protective coating and lining work, including lead and other heavy metals, chromates, asbestos, resins, spent solvents, coating and lining residues, and contaminated abrasives.

The next meeting of Subcommittees D33.12 and D33.14 is in Atlanta, GA, on October 17-19. Subcommittee D33.14 will hold a seminar during the meeting featuring speakers from the Environmental Pro-

tection Agency; Nuclear Regulatory Commission; Duke Power Corp.; Chem Waste Management, Inc.; and William Power Corp.

For more information on Subcommittee D33.12, contact John C. Monday, Specialties Engineering Corp., P.O. Box 9462, San Diego, CA 92109. Additional details on Subcommittee D33.14 are available by writing Jon Cavallo, S.G. Pinney & Associates, P.O. Box 63, Eliot, ME 03903 or Anne McKlinton, ASTM, 1916 Race St., Philadelphia, PA 19103.

In other news, participants are needed for ASTM Subcommittee E12.09 on Scattering, a new subcommittee of standards-writing Committee E-12 on Appearance of Materials. The group's first activity is the development of a standard test method for bidirectional reflection distribution function measurements on specular mirrors.

An organizational meeting of the subcommittee will be held January 15-18, 1989, in Ft. Lauderdale, FL.

For more details, contact Sharon Kauffman at ASTM.

Degussa Corp. Establishes New Chemicals Divisions

Degussa Corp., Ridgefield Park, NJ, has established two new chemicals divisions: Organic Chemicals and Feed Additives Division, and New Products/Processes, Oxy Chemicals, and Peroxygens.

The Organic Chemicals and Feed Additives Division will offer organic chemical specialties, amino acids, and methionine products. The other new division will be responsible for peroxygens and other oxychemicals products such as formaldehyde, methanol, and epoxides, as well as new or advanced products.

Gregory D. Metzler, formerly Director of Marketing for Feed Additives, has been

appointed Vice President/Marketing—Organic Chemicals and Feed Additives Division. Rudi Moerck, formerly Director of Marketing for Active Oxygens, has been named Vice President/Marketing—New Products/Processes, Oxy Chemicals, and Peroxygens.

Jack Anderson to Present NPCA's Keynote Address

Syndicated columnist and investigative reporter Jack Anderson will be the keynote speaker at the Opening Session of the NPCA's 1988 Annual Meeting, in Chicago, IL, on October 17-19. His theme will be "Designing the Future."

Mr. Anderson, whose columns are distributed to over 900 newspapers with an estimated readership of 40 million, has a reputation for being hard hitting but fair. He helped found the 21st Century Institute, a group that is looking ahead to the issues that will lead the U.S. into the next century. Mr. Anderson also is co-Chairman of the Grace Commission, a powerful lobbying group established to study the problem of waste in government.

Born in California and raised in Salt Lake City, UT, Mr. Anderson spent the World War II years in the Far East. In 1947, he joined the staff of noted journalist Drew Pearson, and took over Mr. Pearson's syndicated column in 1969. In 1972, Mr. Anderson was awarded a Pulitzer Prize for national journalism, and in 1986 he received the Abraham Lincoln Award from the International Platform Association as the greatest living professional speaker.

Malaysia Extends Invitation For Scientific Research Cooperation

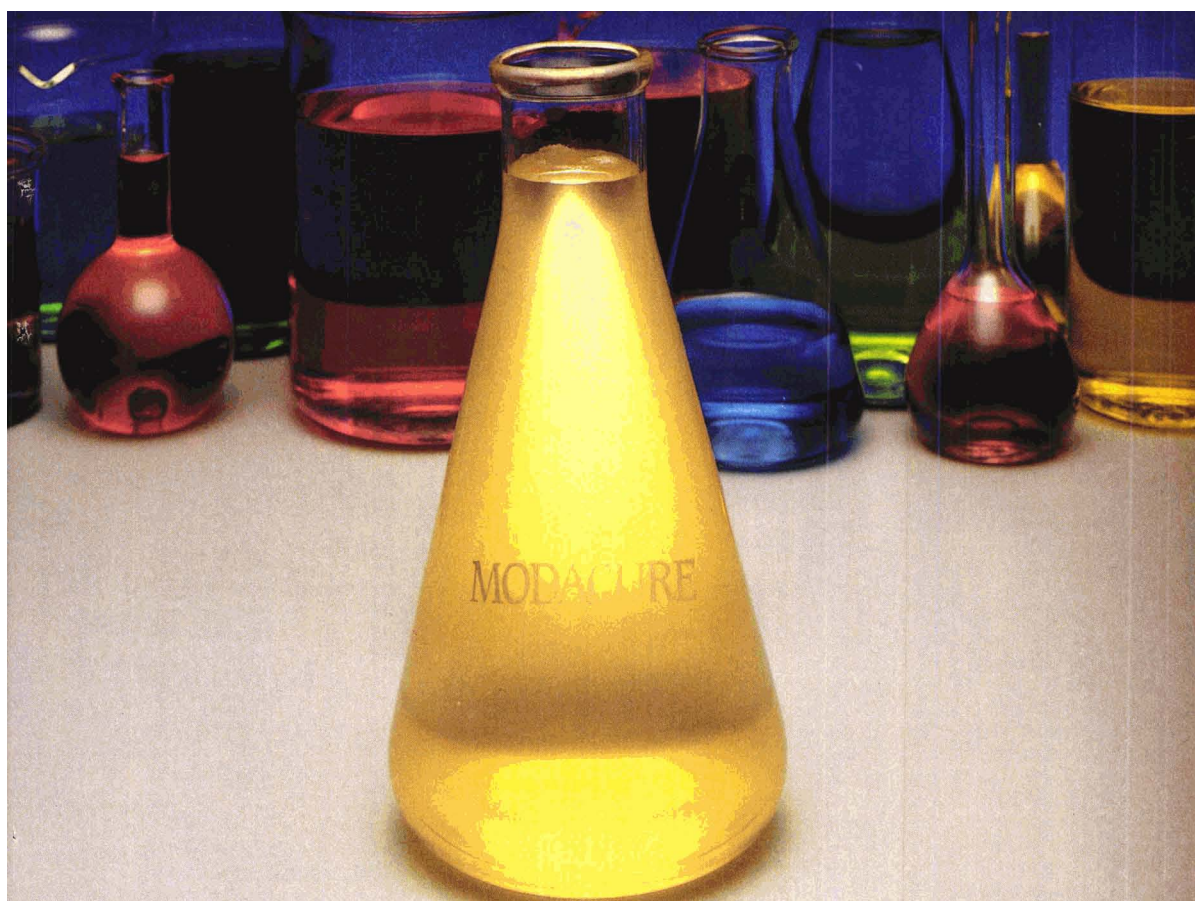
The nation of Malaysia is extending an invitation to members of the Federation of Societies for Coatings Technology to take an interest in research and development activities in their country and possible cooperation with Malaysian scientists, engineers, and technical experts.

In the past few years the U.S. Embassy has begun to promote science and technology ties with Malaysia. Federation members who are planning to travel to Malaysia can have appointments arranged by the U.S. Embassy with Malaysian counterparts. Adequate advance notice must be given to allow these meetings to take place. The Embassy also

will assist in setting up correspondence with a counterpart in Malaysia, if so desired.

Malaysia, located in Southeast Asia, is situated between Singapore and Thailand and has a population of 16 million. Many of their scientists and engineers hold advanced degrees from English-speaking countries. Malaysia has five universities and over a dozen research institutes located in and around Kuala Lumpur and Penang.

For more details, write Jeffrey A. Beller, Science Officer, U.S. Embassy, P.O. Box 10035, 50700 Kuala Lumpur, Malaysia.



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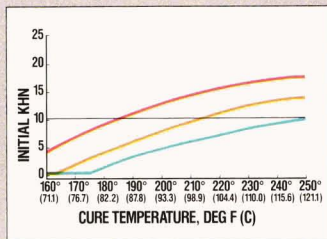
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HUD Demonstration of Lead-Based Paint Abatement To Examine Removal, Encapsulation, and Replacement

The Secretary of Housing and Urban Development (HUD) Samuel R. Pierce, Jr., has announced that HUD will conduct a demonstration program to test different methods of abating lead-based paint in single and multifamily homes. The demonstration, expected to begin this year, will run for one year.

The demonstration program will test commercially available products and systems which can be used in the abatement of the lead-based paint hazard. The results of the test also should provide an estimate of the amount, characteristics, and regional distribution of housing in the U.S. containing lead-based paint hazards in varying levels of contamination. HUD will transmit its final findings to Congress along with any recommendations for legislation.

The demonstration will examine a number of specific topics including: the most reliable technology available for detecting lead-based paint; the most efficient and cost-effective abatement methods; safety considerations in testing; accuracy and reliability of laboratory testing of samples; x-ray fluorescence machines (XRF's) and other available testing procedures; and the availability of qualified samplers and testers.

Lead-based paint abatement methods fall into three generic categories: removal, encapsulation, and replacement. Removal involves taking the paint off surfaces by

scraping or using chemicals; because of the danger to the person doing the abating and the hazardous dust generated, removal by burning, sanding, or sandblasting currently is prohibited. Encapsulation consists of covering the old paint with a surface strong enough to prevent any of the lead-based paint it covers from escaping to the living space. Replacement entails removing the painted items and replacing them with new materials which can be painted with lead-free paint.

Center for Materials Fabrication Conducts Dielectric Heating Research at Battelle

The Center for Materials Fabrication (CMF), Columbus, OH, operated by Battelle Columbus Division, and funded by the Electric Power Research Institute (EPRI), Palo Alto, CA, is conducting research to develop new applications for dielectric heating—the use of microwave or radio-frequency technology. EPRI is a nonprofit institute that conducts research and development on behalf of the U.S. electric utility industry.

The research is designed to benefit companies that heat, dry, or cure plastic, ceramic, or composite materials during manufacturing operations. CMF's target plan is to use real products that currently are being made to real standards under real cost constraints. Testing is funded by CMF and is conducted in collaboration with the EPRI Dielectric Research Program at the University of Texas at Austin.

CMF works with a company whose application has been accepted for the test program. Each test consists of a written plan unique to that application, the testing itself, and a report on the results. The report includes a preliminary assessment of the test results and forecasts of potential reductions in processing time and improvements in product quality.

Management Group Purchases George A. Milton Can Co.

A management group headed by James W. Milton has purchased the George A. Milton Can Co., Inc., Elizabeth, NJ, from the Van Dorn Co., Cleveland, OH. Milton Can has been a division of Van Dorn since 1968.

The company manufactures and distributes a line of containers used predominantly by the paint, food, chemical, pharmaceutical, and household products industries. The sale includes the company's Eagle Can facility in Peabody, MA, as well as the Elizabeth plant.

New Reichhold Division To Produce Specialty Resins

Reichhold Chemicals, Inc., White Plains, NY, has formed a new division—the Coating Polymers and Resins Division, Pensacola, FL. The new division is comprised of the former Newport and Chemical Coatings Divisions.

The President of the division is Laurence Loh, previously President of the Chemical Coatings Division.

The group will produce specialty resins for use in the manufacture of adhesives, inks, and paper, and resins for architectural and industrial coatings.

First consideration is given to EPRI member utilities and their industrial customers. Other criteria in the selection process include the technical uniqueness of the application and the likelihood of economic benefits.

For more information, contact Dave Kuhlmann, CMF, 505 King Ave., Columbus, OH 43201-2693.

Micromeritics Opens New West German Subsidiary

Micromeritics Instrument Corp., Norcross, GA, has announced the establishment of its subsidiary Micromeritics GmbH to serve West Germany. Micromeritics GmbH is located in new offices at Hammfelddamm 10, Neuss.

The new offices include a complete demonstration facility and service center as well as sales and administrative offices.

PPG Chosen as Supplier For Toyota's Kentucky Plant

PPG Industries, Inc., Pittsburgh, PA, has been selected as principal auto finishes supplier for Toyota Motor Manufacturing U.S.A., Inc., Georgetown, KY.

The Coatings and Resins Group of PPG will supply a major portion of topcoat finishes, and all elastomeric and electrodeposition primer coatings, when the plant begins production of the Toyota Camry. Topcoats will be DCT basecoat/clearcoat metallic and DST high-solids enamel finishes. Color-matched elastomeric coatings will be used on flexible plastic body components. Electrodeposition primers will be applied to auto bodies in an electrically-charged emersion process.

Finishes will be produced at PPG's Cleveland, OH, plant, and refinish products will be supplied by the company's Springdale, PA, facility.

Akzo Coatings Plans Production Facility Expansion

Akzo Coatings Inc., Troy, MI, announces a major two-phase expansion project at their Pontiac, MI, production facility that will increase present production capacity by more than 30%.

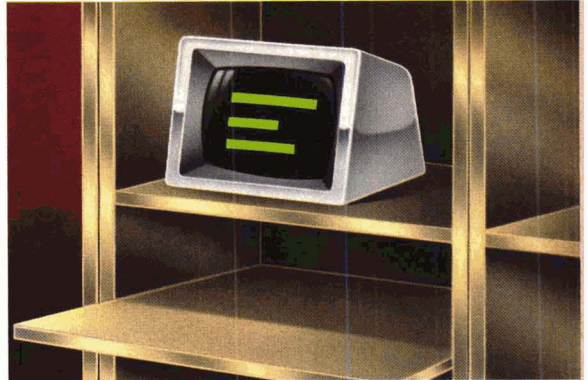
The new plant, which is adjacent to the existing Pontiac production facility, is being built solely to manufacture automotive refinish topcoats and other refinish materials marketed under the Sikkens brand name.

Phase one of the expansion includes a 20,000 sq ft facility equipped with production equipment, and a 8,000 sq ft warehouse and an above ground tank farm to be constructed next to the new facility for raw material storage.

Construction on phase one is slated for completion by the end of the year. Start-up production is scheduled to begin in January 1989 with full production ticketed for June 1989.

Phase two includes construction of an additional 20,000 sq ft facility, expected to begin in the fall of 1989, and the manufacture of Sikkens woodfinish products.

Are Your Urethane Finishes **TOUGH ENOUGH?**



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Today's urethane finishes have to handle a lot of different jobs and hold up to heavy use under less-than-ideal conditions. That's why Rohm and Haas offers a large selection of high performance acrylic polyols for urethane coatings—all backed by extensive testing and technical support. ACRYLOID polyols can help you meet your specifications—*durability . . . high gloss with excellent retention . . . solvent resistance . . . fast tape times, good pot life . . . low VOC and more.*

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known polymer line; RESINS QR-1003 and QR-1004—for improved chemical and solvent resistance; RESINS QR-1033 and QR-1102—for fast lacquer dry and reduced isocyanate demand; RESIN QR-946, new RESIN QR-1166, and REACTIVE MODIFIER QM-1007—for high solids coatings.

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A TRUE MEASURE OF A FINE CLAY

Georgia Kaolin announces the development of two new clays as companions to its Hydrite® kaolins, the industry standard for water-washed specialty clays. These new clays permit smoother, faster dispersion in water based coatings, as well as in traditional non-aqueous paint systems.

The benefits of Hydrite PXH clay include high brightness and controlled particle sizing with a 5+ Hegman grind. The high degree

of pulverization of Hydrite PXH clay allows quick and efficient makedown in a variety of mixing equipment. Its ease of dispersion is well suited to solvent based coatings where good gloss and controlled rheology are important.

Likewise, Hydrite RH clay features a Hegman grind of 5+. However, the unique particle size of Hydrite RH clay contributes to lower binder demand and reduced viscosity, allowing higher

loading levels and more economical filler usage.

Please contact Georgia Kaolin or your GK distributor for more information on these finer-grind clays—Hydrite RH and Hydrite PXH.

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COMBUSTION  ENGINEERING

Regulatory UPDATE

SEPTEMBER 1988

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.

Toxic Release Inventory Reports Fewer than Expected—As of August 5, 1988, only 66,000 toxic release inventory forms had been received by EPA in response to the first deadline for the annual report. The first deadline was July 1, 1988. EPA expected to receive 100,000-300,000 inventory forms.

Under Section 313 of the Emergency Planning and Community Right-to-Know Act (a part of the Superfund Amendments and Reauthorization Act, SARA) a facility that employs 10 or more persons and is in SIC Codes 20-39 must file a toxic release inventory report if it manufactures, imports, processes, or uses more than a threshold quantity of certain chemicals. Approximately 15,800 facilities filed reports.

EPA will issue a notice of non-compliance to facilities for which inaccurate forms were submitted. Facilities not filing could be subject to a fine of up to \$25,000 per day. EPA is still developing the penalty structure it will apply to violations of the release inventory reporting requirement.

For further information, contact the Emergency Planning and Community Right-to-Know Hotline, (202) 479-2449.

OSHA Adds Hazard Communication Standard to Non-Manufacturing Inspections—The Occupational Safety and Health Administration (OSHA) will check for compliance with its revised Hazard Communication Standard during all programmed inspections conducted after August 1, 1988, in covered non-manufacturing industries other than construction. See 53 Federal Register 27679 (July 22, 1988).

The Hazard Communication Standard requires employers to establish hazard communication programs to transmit information on the hazards of chemicals by means of labels on containers, material safety data sheets, and training programs. Originally applicable only to the manufacturing sector, the standard was expanded in 1987 to cover all employees exposed to hazardous chemicals. See 52 Federal Register 31852 (Aug. 24, 1987). The expanded Hazard Communication Standard was scheduled to take effect in May of 1988, but application to non-manufacturing industries was delayed by legal challenges until June 24, 1988.

For further information, contact James Foster, Office of Information and Consumer Affairs, Occupational Safety and Health Administration, 200 Constitution Avenue, N.W., Washington, D.C. 20210, (202) 523-8151.

EPA to Drop Two Coatings Sites from NPL, Add Others—EPA has proposed to remove the "Valley of the Drums" industrial waste dump near Brooks, KY, from the National Priorities List (NPL) of uncontrolled hazardous waste sites. EPA has proposed to remove the A. L. Taylor site (formal name for the 13-acre "Valley of the Drums") from the NPL because all Superfund financed response actions have been implemented. EPA, together with the state, has determined that no further cleanup is appropriate. See 53 Federal Register 26090 (July 11, 1988).

Request documents from the Regional Docket Office, Attention: Gayle Alston, Region IV, U.S. EPA Library, Room G-8, 345 Courtland Street, N.E., Atlanta, GA 30365, (404) 347-4216. For further information, contact Patrick M. Tobin, Director, Waste Management Division, c/o Nancy Dean, Remedial Project Manager, 345 Courtland Street, N.E., Atlanta, GA 30365.

EPA has also proposed to remove an electroplating facility in Roanoke County, VA, from the NPL. Local ground water was contaminated by chromium from the bumper replating and repair facility at the 1.7-acre site. To eliminate the risk of ingesting contaminated drinking water, 30 homes were connected to a waterline extension from a nearby municipal water system. EPA has proposed to remove the site from the NPL because all appropriate response actions have been implemented. See 53 Federal Register 27371 (July 20, 1988).

For further information or to request documents, contact Paul H. Leonard, Remedial Project Manager, Superfund Branch (3HW24), U.S. EPA, 841 Chestnut Street, Philadelphia, PA 19107, (215) 597-8257.

In its seventh major update of the NPL, EPA has proposed to add 229 new sites. Among them are electroplating facilities in Connecticut, Florida, Iowa, Michigan, and Washington. See 53 Federal Register 23988 (June 24, 1988). Sites are added to the NPL because there have been releases or threatened releases of designated hazardous substances or pollutants or contaminants which may present an imminent and substantial danger to the public health or welfare.

Comments were due by August 23, 1988 to Stephen Lingle, Director, Hazardous Site Evaluation Division (Attention: NPL Staff), Office of Emergency and Remedial Response (WH-548A), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460. For further information, contact Robert Myers at the same address or call the Superfund Hotline, (800) 424-9346.

The Regulatory Update is made available as a service to FSCT members, to assist them in making independent inquiries about matters of particular interest to them. Although all reasonable steps have been taken to ensure the reliability of the Regulatory Update, the FSCT cannot guarantee its completeness or accuracy.

EPA Considers New Model, Data for Hazardous Waste Test—EPA is considering a number of changes to the ground water model used to calculate dilution/attenuation factors for organic constituents in EPA's hazardous waste toxicity characteristic. The dilution/attenuation factor represents the reduction in toxicant concentration expected during transport from a landfill to a drinking water source. Wastes whose leachrate concentrations are expected to produce unacceptable toxicant levels at a drinking water source are regulated as a hazardous waste.

Changes to the subsurface fate and ground water transport model include recognition of an unsaturated zone separating the landfill from the ground water; new assumptions regarding nearby well location; and new calculations recognizing distance of the well from the toxicant source. EPA is considering using the new model in modifying the hazardous waste toxicity characteristic used by waste generators to determine whether their solid wastes are hazardous. In addition, the new model may be used in evaluating petitions to remove substances from the hazardous waste list. EPA is also considering new landfill, soils, climatic, and chemical specific data that may be used in the subsurface fate and transport model. See 53 Federal Register 28892 (Aug. 1, 1988).

Changes to the toxicity characteristic and the underlying compound specific dilution/attenuation factors and their subsurface fate and transport models were proposed in 1986. See 51 Federal Register 21648 (June 13, 1986) and 53 Federal Register 18024 (May 19, 1988). EPA is still considering a shift from organic constituent specific dilution/attenuation factors to generic dilution/attenuation factors.

Comments were due in quadruplicate by August 31, 1988, at EPA RCRA Docket (S-212), Attention: Docket No. F-88TC3N-FFFFF, U.S. EPA (WH-562), 401 M Street, S.W., Washington, D.C. 20460. For further information contact the RCRA Hotline, (800) 424-9346, or call John Goodrich-Mahoney, (202) 475-8551. For information on the technical aspects of the model, call Zubair Saleem, (202) 382-4770. For information on the use of the model in delisting, contact Scott Maid, (202) 382-4783. All information contact addresses are Office of Solid Waste, U.S. EPA (WH-562B), 401 M Street, S.W., Washington, D.C. 20460.

EPA Proposes Alternative Approaches to Benzene Standard—EPA has proposed four policy approaches it may use to re-establish a national emission standard for the hazardous air pollutant benzene. Standards for ethylbenzene/styrene plants, benzene storage vessels, and equipment that may leak benzene could be affected by selection of one of the four proposed policy approaches. See 53 Federal Register 28496 (July 28, 1988).

Each of the four approaches treats the decision on acceptable risk from benzene exposures differently. Under the case-by-case approach, all health information, risk measures, potential biases, underlying assumptions, and uncertainties are considered in making the acceptable risk decision. The incidence based approach proposes as acceptable one case per year per source category. The maximum individual risk approach considers only maximum individual lifetime risk and proposes a risk of 1×10^{-4} as acceptable. The fourth approach is a variation of the maximum individual risk approach that defines a risk of 1×10^{-6} as acceptable. The final decision on the benzene policy approach will provide the framework for future national emission standards for hazardous air pollutants.

Under the Clean Air Act, EPA must set emission standards for hazardous air pollutants at a level that provides an ample margin of safety to protect public health. Setting the standards involves determining an acceptable risk level and setting a standard no higher than the acceptable level that provides an ample margin of safety. In making the margin of safety decision all health risk measures, technical feasibility, cost, uncertainty, and economic impacts are considered.

A public hearing was held on September 1, 1988, at the U.S. Department of Agriculture Auditorium, Washington D.C.

Comments are due in duplicate by October 3, 1988 at: Central Docket Section (LE-131), Attention (appropriate docket number), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460. The docket numbers are:

OAQPS 79-3 Part I: benzene health effects;
A-79-49: ethylbenzene/styrene process vents;
A-80-14: benzene storage vessels; and
A-79-27: benzene equipment leaks.

For further information on benzene storage vessels, contact Gail Lacy, Standards Development Branch, Emission Standards Division, (MD-13), (919) 541-5261. For information on benzene leaks, or ethylbenzene/styrene process vents, contact Janet Meyer, Standards Development Branch, Emission Standards Division, (MD-13), (919) 541-5254. For information on the health effects of benzene and the risk assessment, contact Ila Cote, Pollutant Assessment Branch, Emissions Standards Division, (MD-13), (919) 541-5342. All information addresses are U.S. EPA, Research Triangle Park, NC 27711.

Waste Reduction Bill Passes House Commerce Committee—The House Energy and Commerce Committee has approved the Waste Reduction Act of 1988, clearing the way for consideration by the full House of Representatives. The bill encourages reduction in the amount of waste generated, sets up an Office of Waste Reduction and a national clearing house on waste recycling and reduction techniques within EPA.

Under the bill, EPA would be required to develop and implement strategies to promote waste source reduction; investigate methods of coordinating and streamlining data collection requirements already in existence under environmental statutes; determine how EPA should measure waste generation and management; aid business in adopting source reduction techniques; and provide measurable goals, by which to judge EPA strategies for achieving waste reduction.

Additionally, companies required to file under Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act, SARA) would be required to include a toxic chemical source reduction and recycling report with their submission. This report would include the quantity of listed chemicals entering into a waste stream prior to recycling, treatment or disposal, and the percent change from the previous year; the amount of chemicals recycled and the percentage change from the previous year; and the source reduction practices used specifically in the areas of reformulation or redesign of products and substitution of raw materials.

For further information, contact David Colbert, Committee on Energy and Commerce, U.S. House of Representatives, 2125 Rayburn House Office Building, Washington, D.C. 20515, (202) 225-9304.

Community Right-to-Know Trade Secrets Rule Issued—EPA has published a final rule establishing the procedure for trade secrecy claims under The Emergency Planning and Community Right-to-Know Act. The rule makes clear that the only information that may be withheld from a public report is the identity of a chemical found at a facility. See 53 Federal Register 28772 (July 29, 1988). The rule includes procedures the public must follow to petition for the disclosure of chemical identity claimed as a trade secret. It also interprets a section of the law to mean that a facility may not withhold a specific chemical identity from a health professional under any circumstances, provided there is a written statement of need and a written confidentiality agreement. The rule took effect on August 29, 1988.

The Emergency Planning and Community Right-to-Know Act (enacted as part of the Superfund Amendments and Reauthorization Act, SARA) requires certain facilities to report to EPA, state, and local authorities the presence, use, and release of certain chemicals. The law also allows the facility to claim the identity of a chemical as a trade secret under certain circumstances. EPA's final rule implements the trade secrecy provisions of the Act by defining a trade secret and describing how EPA will handle trade secrecy claims made by facilities reporting under Sections 303, 311, 312, and 313 of the Act.

A trade secrets claim can be made with respect to five types of submissions: 1) the notification to a local emergency planning committee of any changes at a facility that would affect emergency plans; 2) answers to questions posed by local emergency planning committees; 3) material safety data sheets or chemical lists; 4) Tier II emergency and hazardous chemical inventory forms; and 5) the toxic release inventory form.

For further information, contact Beverly D. Horn, Attorney-Advisor, Office of General Counsel, Contracts and Information Law Branch, LE-132G, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-5460, or call the Emergency Planning and Community Right-to-Know Information Hotline (800) 535-0202, or in Washington, D.C. and Alaska (202) 479-2449.

Clarification of "Federally Permitted Release" Proposed—EPA has proposed a clarification of the Superfund law's federally permitted release exception that would limit the exemption to certain permitted releases listed in the law. Under the proposed clarification, a release that exceeds a permit limit will not be considered a federally permitted release and EPA notification will be required when the release exceeds its permitted level by a reportable quantity (RQ) or more. See 53 Federal Register 27268 (July 19, 1988).

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), the person in charge of a facility from which a hazardous substance has been released in a certain quantity (i.e., the reportable quantity) must notify the government. Notification is not required, however, for federally permitted releases. The law lists the general types of releases that are exempt from the notification requirement. EPA's proposed clarification parallels the CERCLA list and provides additional detail in a definition of the term "federally permitted release."

The Emergency Planning and Community Right-to-Know Act (a part of the Superfund Amendments and Reauthorization Act, SARA) requires reporting parallel to the CERCLA requirements but is intended to make release information immediately available to state and local emergency officials as well as to the Federal officials notified

under CERCLA. EPA is proposing a change in its community right-to-know rules to clarify that this reporting requirement does not apply to federally permitted releases.

Comments on both changes are due in triplicate by September 19, 1988 at Emergency Response Division, Superfund Docket Clerk, Attention: Docket No. 101(10) FPR, Room LG-100, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460.

For further information, contact Hubert Watters, Project Officer, Response Standards and Criteria Branch, Emergency Response Division (WH-548B), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-2463, or the RCRA/Superfund Hotline, (800) 424-9356.

EPA to Revise Waste Facility Ground Water Monitoring Rules—EPA has proposed amendments to the ground water monitoring regulations for permitted RCRA facilities which treat, store, or dispose of hazardous waste. See 53 Federal Register 28160 (July 26, 1988). Ten changes have been proposed to allow for the early detection of leaks and to better tailor the current ground water monitoring regulations to site-specific conditions. Under the current regulations, facility owners and operators are required to sample ground water at predetermined time intervals to determine whether hazardous wastes originating from their facility are contaminating the ground water. If the proposed amendments are adopted, facilities required to monitor ground water may have to modify current practices.

Among the proposed changes are a requirement that the "no migration" demonstration be based on site-specific field work or predictions that assume maximum contaminant migration; authorization for EPA to require an owner or operator to monitor a well and to impose monitoring quality assurance and control requirements.

Comments are due in triplicate by September 26, 1988, at Docket Clerk, Attention: Docket No. F-88-AGWP-FFFFF, Office of Solid Waste, (WH-562), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460. For further information, contact Joseph M. Abe, Office of Solid Waste, Waste Management Division, Land Disposal Branch, (OS-321), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-4654, or call the RCRA/Superfund Hotline, (800) 424-9346.

Small Scale Treatability Study Wastes Exempted—EPA has conditionally exempted waste samples used in small scale treatability studies from EPA's hazardous waste regulations. Generators of the waste samples and owners or operators of laboratories or testing facilities conducting small scale treatability studies are now exempt from the Subtitle C hazardous waste regulations, including the permitting requirements, when certain conditions are met. See 53 Federal Register 27290 (July 19, 1988).

By final rule, EPA now provides an exemption of 1000 kg of non-acute hazardous waste per waste stream per treatment process; 1 kg of acute hazardous waste per waste stream per treatment process; or 250 kg of soils, water, or debris contaminated by acute hazardous waste per waste stream per treatment process. The rule makes clear that the treatability study exemption is for the evaluation of a treatment process and is not to be used instead of commercial treatment or disposal. The rule also provides shipment limitations, a treatment rate limit, storage limits, and time limits on the storage of residues and unused samples.

For further information, contact Mike Petruska, Office of Solid Waste (WH-562B), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 475-9888 or the RCRA/Superfund Hotline (800) 424-9346.

Ethylene Oxide Excursion Limits Take Effect—Compliance with the Occupational Safety and Health Administration's (OSHA) new ethylene oxide excursion standard is required on September 6, 1988, but information collection requirements related to the new excursion standard have been delayed until October 6, 1988. See 53 Federal Register 27959 (July 26, 1988). OSHA has added to the existing eight-hour standard the new excursion limit of five parts of ethylene oxide per million parts of air (5 ppm) averaged over a maximum sampling period of 15 minutes. See 53 Federal Register 11414 (Apr. 6, 1988).

September 6, 1988 is the deadline for compliance with the 5 ppm excursion limit, the institution of work practice controls, and making provision for and selecting respirators. The deadline for implementation of engineering controls required by the rule is December 6, 1988.

The delay in the effective and compliance dates of the information collection portions of the rule were caused by delays in the Office of Management and Budget's (OMB) review of new information collection requirements related to the excursion limit. The information collection requirements include an objective data exclusion, exposure monitoring, compliance and respirator program requirements,

and requirements to communicate ethylene oxide hazards to employees.

For further information, contact James Foster, Occupational Safety and Health Administration, Office of Public Affairs, Room N-3649, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210, (202) 523-8151.

EPA Receives Wire Enamel Solvent, Other Test Data—EPA has announced the receipt of test data on cresols used as wire enamel solvents, as organic intermediates in manufacturing phenolic resins and phosphate esters, and as antioxidants. EPA has received reports on a number of mutagenicity tests on ortho-, meta-, and para-cresol pursuant to a final test rule under the Toxic Substances Control Act. See 53 Federal Register 27564 (July 21, 1988).

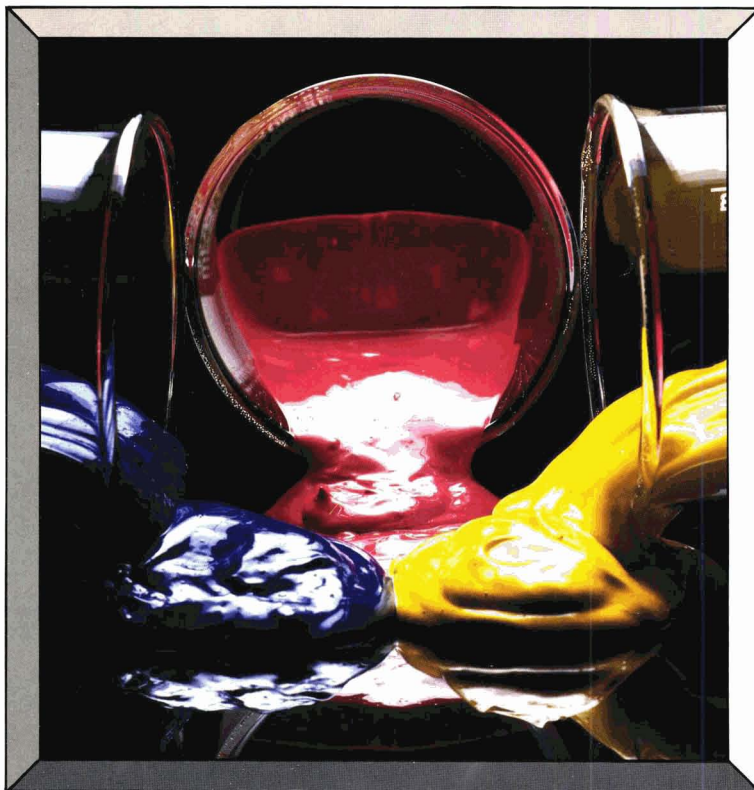
EPA has also received test data for the C9 aromatic hydrocarbon fraction used in solvents. The data describe an inhalation developmental toxicity study in mice.

For further information, contact Michael M. Stahl, Acting 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.

SUMMARY CALENDAR OF REGULATORY ACTIONS

August 29, 1988	EPA's final rule on Community Right-to-Know trade secrets claims procedures takes effect. (See this issue.)
August 31, 1988	Comments due to EPA on the model and data used to calculate dilution/attenuation factors in the hazardous waste toxicity characteristic. (See this issue.)
September 1, 1988	Public heading on EPA's proposed policy approaches for a benzene national emission standard for hazardous air pollutant (NESHAP). (See this issue.)
September 2, 1988	Post-hearing briefs due for OSHA air contaminant standards hearing. (See August issue.)
September 6, 1988	Compliance with OSHA ethylene oxide excursion rule required. (See this issue.)
September 14, 1988	CPSC policy on labeling household products containing methylene chloride takes effect with respect to products packaged after this date. (See February issue.)
September 19, 1988	Comments due to EPA on clarification of "federally permitted release" exceptions from CERCLA and SARA reporting requirements. (See this issue.)
September 26, 1988	Comments due to EPA on changes to the waste facility ground water monitoring regulations. (See this issue.)
October 3, 1988	Comments due on EPA's proposed policy approaches for a benzene national emission standard for hazardous air pollutant (NESHAP). (See this issue.)
October 6, 1988	Compliance with OSHA ethylene oxide rule information collection requirements required. (See this issue.)

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Wednesday, Thursday, Friday • October 19, 20, 21, 1988

Preliminary Program

“Performance and Compliance: The Challenge Intensifies”

===== WEDNESDAY, OCTOBER 19 =====

OPENING SESSION* **(9:00)**

Sixty-Sixth Annual Meeting of the Federation of Societies for Coatings Technology opened by President Deryk Pawsey

Invocation and In Memoriam

Welcome: Evans Angelos, President of Chicago Society for Coatings Technology

Audrey LeNoble and Rudolph Albrecht, Co-Chairmen of the Host Committee

Richard M. Hille, Chairman of the Program Committee

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

Introduction of Distinguished Guests

E. W. FASIG KEYNOTE ADDRESS* **(10:00-11:00)**

What's Right with America—Douglas Edwards, Award-Winning Television and Radio Broadcaster

***Note:** Opening Session and Keynote Address will be presented in the Ballroom of the McCormick Center Hotel, which is adjacent to McCormick Place North

SEMINAR ON AEROSOL PAINTS **(2:00-4:00)**

Aerosol Paint Formulation: General Considerations—Gus W. Leep, Vice-President, Research & Development, Seymour of Sycamore, Inc., Sycamore, IL

Water-Based Aerosol Paints: Formulation and Packaging—Edward Clutter, DAP Inc., Dayton, OH

Paint Valves and Actuator Systems—Carleen Kreider, Director, Research & Development, Seaquist Valve Co., Div. of Pittway Corp., Cary, IL

Statistical Process Control in Aerosol Filling—Daniel R. Baker, Quality Assurance Manager, McWhorter, Inc., Carpentersville, IL

UPDATE ON TOXIC REGULATIONS **(2:00-5:00)**

Overview of Governmental Regulations in the Coatings Industry—Richard S. Sayad, Manager, Health & Environmental Services, Epoxy Resins and Intermediate Products, Dow Chemical U.S.A., Midland, MI

Target Organ Labeling of Coatings—Stephen R. Sides, Associate Director, Health and Safety, National Paint and Coatings Association, Washington, D.C.

Complying with Proposition 65—Patrick M. Meehan, Division Counsel, The Clorox Company, Oakland, CA

VOC Measurement: How to Understand It, Live with It, and Manage It—Hiroshi Fujimoto, Technical Manager, Analytical Services, Coatings and Inks Div., BASF Inmont Corp., Detroit, MI

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

Evaluation of Preservatives: Designing the Optimal Test System—P. K. Cooke, U. R. Gandhi, E. L. Leasure, and E. S.



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Lashen, Rohm and Haas Co., Research Laboratories, Spring House, PA

Current Studies of Curing of Polyester-Melamine Enamels; Possible Effects on Coating Performance—Shubang Gan, Robert D. Solimeno, and Frank N. Jones, Dept. of Polymers and Coatings, North Dakota State University, Fargo, ND, and Loren W. Hill, Monsanto Polymer Products Co., Springfield, MA

Importance of Physico-Chemical Aspects in the Design of Powder Paint Resins—P. J. Greidanus, DSM Resins BV, Zwolle, The Netherlands

Surface Chemistry of ZDP, a Lubricant Additive—Kent L. Rhodes and Peter C. Stair, Dept. of Chemistry, Center for Engineering Tribology, Northwestern University, Evanston, IL

THURSDAY, OCTOBER 20

ADVANCES IN EPOXY RESIN TECHNOLOGY (9:00-11:00)

Epoxy-Urethane-Acrylic Interpenetrating Polymer Networks (IPNs) for Primer Applications—Detroit Society for Coatings Technology.

A New Epoxy Resin for Low Gloss Powder Coatings—J. F. Sanford and J. L. Hart, Plastics Dept., Dow Chemical U.S.A., Freeport, TX

Fundamental Studies of Epoxy Resins for Can and Coil—II. Flexibility and Adhesion of Epoxy Resins—J. L. Massingill, P. S. Sheih, R. C. Whiteside, and D. E. Benton, Resin Products Dept., Dow Chemical U.S.A., Freeport, TX

The Elastification of Epoxy Resins by Urethane Polymers—Gerhard Ruttman and William Cibulas, Coatings Div., Mobay Corp., Pittsburgh, PA

R & D TOOLS (9:00-11:00)

Experimental Design and Its Use in Powder Coating Evaluation—Gordon C. Fischer, Project Leader, Resins Research Dept., Dow Chemical U.S.A., Freeport, TX (A Ronn Awards competition paper)

Comparison of Absolute Viscometers Capable of Measuring Viscosities in the Ultra-Low Shear Rate Range—Cleveland Society for Coatings Technology. Presented by Freidun Anwari, Coatings Research Group, Inc., Cleveland, OH

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

Room Temperature Curatives for Carboxylated Coatings—Golden Gate Society for Coatings Technology. Presented by Robert D. Athey, Jr., Athey Technologies, El Cerrito, CA

MANUFACTURING COMMITTEE SEMINAR ON PRODUCTIVITY MEASUREMENT FOR PROFITABILITY IN COATINGS MANUFACTURING (9:15-11:30)

Moderator—Joseph P. Walton, Executive Vice-President, Jamestown Paint & Varnish Co., Jamestown, PA (Chairman, FSCT Manufacturing Committee)

Fundamentals of Organizational Improvement—Gene K. Groff, Georgia State University, Atlanta, GA

Registration Hours

Tuesday, October 18 8:00 am-5:00 pm

Wednesday, October 19 8:00 am-5:30 pm

Thursday, October 20 8:00 am-5:30 pm

Friday, October 21 8:00 am-3:00 pm

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Alternative Methods for Productivity Measurement—John W. Covington, Principal, Covington Manufacturing Consultants, Millersville, MD

Productivity Measurement—What It Is and What It Isn't—Larry H. Dalton, Vice-President-Manufacturing, Lilly Industrial Coatings, Indianapolis, IN

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

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

NON-AQUEOUS RESIN CHEMISTRY AND PERFORMANCE (1:30-4:00)

Solvent-Diffusion and Drying of Coatings—R. Allen Waggoner and Frank D. Blum, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO (A Roon Awards competition paper)

Curing of Pigmented Alkyd Coatings Monitored by Photo-Acoustic Fourier Transform Infrared Spectroscopy—Marek W. Urban and Evelisse M. Salazar-Rojas, Dept. of Polymers and Coatings, North Dakota State University, Fargo, ND (A Roon Awards competition paper)

Improvement of Abrasion Resistance with UV Curing—H. Ishikawa and M. Motomura, Dainippon Ink & Chemicals, Inc., Tokyo, Japan

Advanced Polymeric Materials for Coating Technology—F. Ciardelli, G. Ruggeri, M. Aglietto, and D. Angiolini, Dept. of Chemistry and Industrial Chemistry, University of Pisa, Pisa, Italy, C. Carlini, Dept. of Industrial Chemistry and Materials, University of Bologna, Bologna, Italy, G. Bianchini and G. Siccardi, IVI-PPG, Alessandria, Italy, and G. Bigogno and L. Cioni, Salchi SpA, Milano, Italy (Presented on behalf of FATIPEC: Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe)

An Update on Styrenated Alkyds—Raymond B. Seymour, Robson F. Storey, Omelia A. Lee, and Pat Bynum, Dept. of Polymer Science, University of Southern Mississippi, Hattiesburg, MS

WATER-BORNE TECHNOLOGY (1:30-3:00)

Phase Behavior of Water-Borne Coatings—Pamela Kuschnir, Scientist, and F. Louis Floyd, Technical Manager, Coatings Research Dept., The Glidden Co., Dwight P. Joyce Research Center, Strongsville, OH (A Roon Awards competition paper)

Understanding the Sensitivities of Water-Borne Latex Coatings Thickened with Associative Thickeners—A. Karunasena and J. E. Glass, Dept. of Polymers and Coatings, North Dakota State University, Fargo, ND (A Roon Awards competition paper)

The Mechanism of Film Formation from Polymer Latices—Sarah T. Eckersley and Alfred Rudin, Chemistry Dept., University of Waterloo, Waterloo, Ontario, Canada (A Roon Awards competition paper)

PIGMENTS AND DISPERSION (3:00-4:00)

Quantifying Pigment Dispersion—II. Iron Oxide Pigments—Montreal Society for Coatings Technology. Presented by John E. Hall, Manager of Coatings Technical Service, Tioxide Canada Inc., Sorel, Quebec, Canada

Surface Studies of Titanium Dioxide Pigments—Tuomi Losoi, Kemira Oy, Vuorikemia Plant, Pori, Finland (Presented on behalf of Scandinavian Paint and Varnish Technologists)

CORROSION COMMITTEE SYMPOSIUM ON REGULATION AND ITS EFFECT ON CORROSION PROTECTION (1:30-5:00)

Introduction and Overview—M. Jay Austin, Technical Director, Halox Pigments, A Division of Hammond Lead Products, Inc., Hammond, IN (Chairman, FSCT Corrosion Committee)

Skunk Oil for Compliant Corrosion Control (Keynote Presentation)—John A. Gordon, Coatings Consultant, Pacific Technical Consultants, Loma Linda, CA

Alternative Compliant Coating Systems for Heavy-Duty Maintenance Applications—Orville Brown, Manager, Industrial Laboratory, M.A. Bruder & Sons, Inc., Philadelphia, PA

Paint Show Hours

Wednesday, October 19 11:00 am-5:30 pm

Thursday, October 20 9:00 am-5:30 pm

Friday, October 21 9:00 am-3:00 pm

Regulatory Impacts on the Industrial/Trade Sales Market—James O'Connor, Manager, Industrial Product Development, Rust-Oleum Corp., Evanston, IL

High Performance Water-Borne Coatings—David Watson, Market Manager, Maintenance & Marine, Rohm and Haas Co., Philadelphia, PA

VOC Compliant Inorganic Zinc-Rich Coatings—Thomas Ginsberg, R & D Dept., Union Carbide Corp., Bound Brook, NJ

OEM/Industrial Finishes—(Speaker to be announced)

FRIDAY, OCTOBER 21

SYMPOSIUM ON AUTOMOTIVE COATINGS (9:00-10:30)

The Effect of Substrate and Paint Layers on the Roughness and Appearance of a Silver Basecoat/Clearcoat System—G. Dale Cheever, Staff Research Scientist, and Phuong-Anh P. Ngo, Associate Scientist, Polymers Dept., General Motors Research Laboratories, Warren, MI

New Anti-UV Stabilizers for Automotive Coatings—Lahos Avar, H. Bohnke, and E. Hess, Chemical Div., Sandoz AG, Basel, Switzerland

Viscosity/Solids Performance of Experimental Polyol Resins Functionalized with Hydroxy(meth)acrylates—Phillip W. Barnett, Senior Development Chemist, Resin Products Technical Service & Development, Plastics Dept., Dow Chemical U.S.A., Freeport, TX

ANNUAL BUSINESS MEETING (9:30-10:30)

Annual Business Meeting of the Federation

Presentation of these awards: American Paint & Coatings Journal/A.F. Voss . . . Armin J. Bruning . . . Materials Marketing Associ-

ates . . . Outstanding Service . . . Society Speaker . . . Southern Society A. L. Hendry . . . Ernest T. Trigg.

Installation of Officers, 1988-89

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

Microgels—Intramolecularly Crosslinked Macromolecules—Potent Components of Organic Coatings—Dr. Werner Funke, Professor for Polymer Chemistry, University of Stuttgart, and Associate of the Research Institute for Pigments and Paints, Stuttgart, West Germany

AWARDS LUNCHEON* (11:45)

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

Featured Speaker: Dick Flavin, Social Satirist and Political Humorist.

*Note: Awards Luncheon will be in the Ballroom of the McCormick Center Hotel

**FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1988 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
McCORMICK PLACE NORTH, CHICAGO, ILLINOIS
WEDNESDAY, THURSDAY AND FRIDAY, OCTOBER 19, 20, 21**

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.

**"PERFORMANCE AND COMPLIANCE:
THE CHALLENGE INTENSIFIES"**

The theme of the 1988 Annual Meeting underscores the impact of regulatory restrictions on the coatings industry, which must respond to the dual challenges of producing quality products while meeting increasingly restrictive compliance standards. Programming will focus on such areas as corrosion protection, aerosol coatings, "high tech" coatings research, and the major regulatory issues affecting coatings formulation and manufacture. 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, Europe, and Japan will utilize over 67,000 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.

**HOTELS AND RESERVATIONS:
CHICAGO HILTON IS HEADQUARTERS**

Eight hotels in Chicago have reserved blocks of rooms for the Annual Meeting and Paint Show. The headquarters hotel will be the newly-renovated, 1600-room Chicago Hilton and Towers.

The other cooperating hotels are: Essex Inn, Congress, Palmer House and Towers, McCormick Center, Hyatt Regency, Best Western Inn of Chicago, and Days Inn-Lake Shore. Please refer to map in this brochure showing location of hotels and schedule of rates.

Rooms are subject to a 12.1% occupancy 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.

Additions, changes and cancellations—prior to September 19—must be submitted in writing to FSCT, c/o Chicago Convention & Visitors Bureau, McCormick Place-on-the-Lake, Chicago, IL 60616. After September 19, please direct all inquiries to the hotel, the phone numbers of which are (Area Code 312):

Chicago Hilton	. 922-4400	McCormick Center	. . . 791-1900
Essex Inn 939-2800	Hyatt Regency 565-1234
Congress 427-3800	Best Western 787-3100
Palmer House	. . 726-7500	Days Inn-Lake Shore	. 943-9200

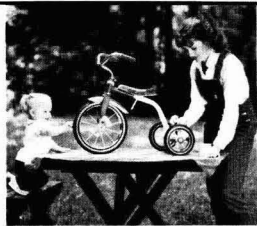
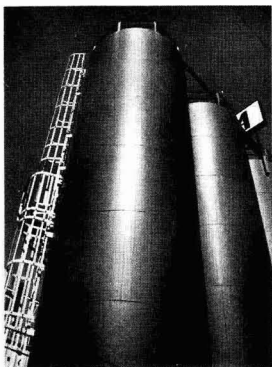
Reservations for the Palmer House and Towers will be accepted for arrival beginning Wednesday, October 19, only. Any reservations requesting the Palmer House for arrival prior to October 19 will be assigned to another hotel.

Requests for accommodations at either the Chicago Hilton or McCormick Center will be limited to ten rooms per company. A parlor counts as one room. Many hotels require deposits. Please read your confirmation carefully. If a deposit is required, *mail it directly to the hotel.*

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30' 319

27' UNION CARBIDE
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231 I. MINERALS 227

30' AMOCO
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205 MIN. PIG.
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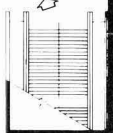
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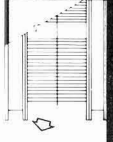
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1988 PAINT INDUSTRIES' SHOW

October 19 - 20 - 21 ● McCormick Place-North Hall

Chicago, Illinois



Spouses Activities

Wednesday, October 19

2:00 p.m. Activities for the spouses will begin with a "Get Acquainted Wine and Cheese Social" in the Williford Room of the Chicago Hilton Hotel. Wine courtesy of Pfizer, Inc. There will be door prizes and favors contributed by exhibitors in the Paint Show and other suppliers to the industry.

Thursday, October 20

7:30 a.m. Continental Breakfast will be served in the Williford Room of the Hilton.

9:30 a.m. Buses will leave from the Eighth St. entrance of the hotel for a tour of the University of Chicago and the nearby Museum of Science and Industry. The group will be treated to a private organ recital at the University's Rockefeller Chapel.

Luncheon will be served in the elegant Guildhall of the Ambassador West Hotel. After lunch the spouses will be entertained by Four Hits and a Miss, a group of vocalists who delight their audi-

ences with the close harmonies of swing era music infused with an original comic spirit.

Friday, October 21

7:30 a.m. Continental Breakfast at the Hilton.

12:00 noon The Annual Luncheon will be held at the McCormick Center Hotel. Several Federation Awards will be presented, including the Roon Foundation, Paint Show, George Baugh Heckel, and Union Carbide. Two pairs of first-class round-trip tickets, for any destination in the continental United States, will be the special door prizes. One pair of tickets will be for United and one pair for Delta Airlines. The featured speaker will be Dick Flavin, of NBC's Sunday Today show. A social satirist and political humorist, he is one of America's most entertaining speakers.

The spouses registration fee (\$35.00 in advance, \$45.00 in Chicago) includes the wine and cheese social, the continental breakfasts, and the Thursday tour and luncheon. Tickets for the Friday luncheon are available for \$20.00 in the registration area at McCormick Place North.

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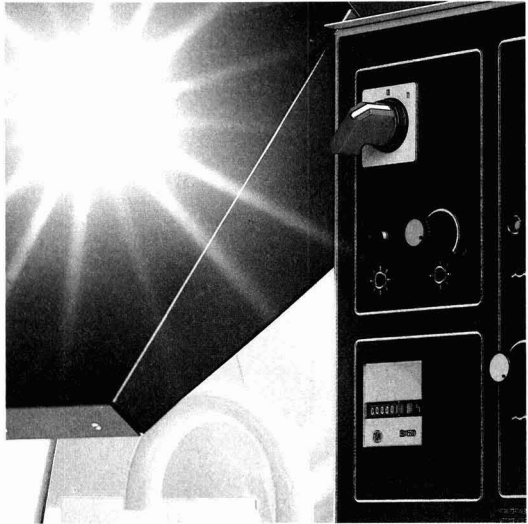
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Reichhold Chemicals, Inc.	617
Renzmann Inc.	969
Reynolds Industries, Inc.	344
Rhone-Poulenc Inc.	753
Rohm and Haas Co.	701
Rosedale Products, Inc.	1047
Russell Finex, Inc.	526
Sandoz Chemicals Corp.	939
Sanyo-Kokusaku Pulp Co., Ltd.	153
Schold Machine Co.	183
Semi-Bulk Systems, Inc.	568
Serac, Inc.	983
Shamrock Technologies, Inc.	150
Sheen Instruments Corp.	980
Shell Chemical Co.	744
Sherex Polymers, Inc.	879
Sherwin-Williams Chemicals Co.	439
Silberline Manufacturing Co., Inc.	921
Sonoco Fibre Drum, Inc.	1054
South Florida Test Service	574
Spartan Color Corp.	530
Stone Container Corp., Bag Div.	445
Sub-Tropical Testing Service	937
Sun Chemical Corp.	383
Sylvachem Corp.	991
Tammco, Inc./Unimin Corp.	1043
Tego Chemie Service USA	611
Texaco Chemical Co.	1039
Tiele Engineering Co.	946
Tokheim Corp., Process Controls Div.	679
Troy Chemical Corp.	119
U.S. Silica Co.	940
Unimin Corp./Tammco, Inc.	1043
Union Carbide Corp.	301
Union Process, Inc.	700
United Catalysts, Inc.	282
Universal Color Dispersions	405
Unocal Chemicals Div., Unocal Corp.	783
R.T. Vanderbilt Co., Inc.	409
Velsicol Chemical Corp.	963
Viking Pump-Houdaille, Inc.	413
Vorti-Siv Div. of M&M Machine, Inc.	920
Wacker Silicones Corp.	169
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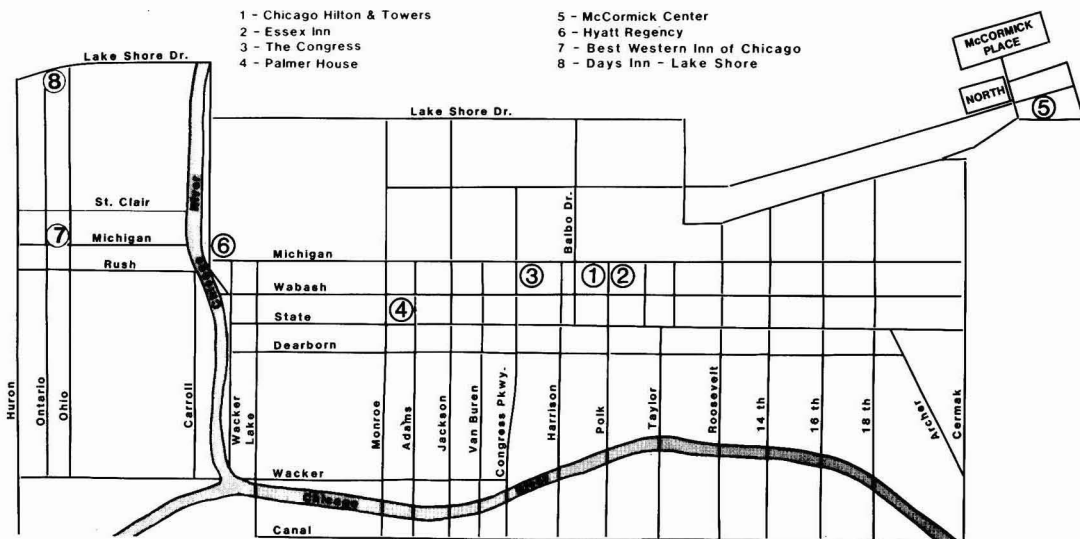
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(1)	119	Chicago Hilton Towers	175-190	200-215	390-870
(2)	106	Essex Inn	68-74-78	78-84-88	150-250
(3)	115	Congress	70-80	85-95	150-350 225-425 1 BR 2 BR
(4)	112	Palmer House & Towers	100-115 130-145	120-135 150-165	260 & Up 515 & Up 1 BR 2 BR
(5)	110	McCormick Center	99-145	119-165	325-950
(6)	113	Hyatt Regency	130	155	325-625 450-850 1 BR 2 BR
(7)	220	Best Western Inn of Chicago	85-90	90	205-375
(8)	213	Days Inn-Lake Shore	89	99	

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McCORMICK PLACE, CHICAGO, ILLINOIS
WEDNESDAY, THURSDAY, AND FRIDAY, OCTOBER 19, 20, 21



APPLICATION FOR HOTEL ACCOMMODATIONS

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McCormick Place-on-the-Lake
Chicago, IL 60616

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3.	<input type="text"/>	<input type="text"/>	<input type="text"/>
4.	<input type="text"/>	<input type="text"/>	<input type="text"/>

NAMES OF ROOM OCCUPANTS AND DATES OF ARRIVAL/DEPARTURE

Type of Room	Name	Dates	
		Arrive	Depart

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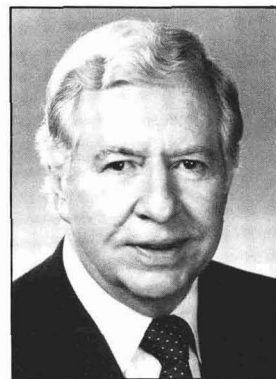


**1988 Annual Meeting
Paint Industries' Show
October 19, 20, 21, 1988
McCormick Place-North
Chicago, IL**

**Opening Session
Wednesday, October 19**

**Keynote Address
"What's Right with America"
Douglas Edwards**

The career of television and radio broadcaster, Douglas Edwards, is one of the most distinguished in journalism. In 1946, he was the premier anchor for the weekly "CBS Television News," and in 1948 became anchor of the network's first Monday through Friday evening news show, which came to be called "Douglas Edwards and the News." The show won the George Foster Peabody Award for "Best TV News." Mr. Edwards was recently awarded the Lowell Thomas Award for his contributions to the field of journalism. Until his retirement this year, he anchored the mid-morning edition of "Newsbreak" and the award-winning Sunday morning series, "For Our Times."



Douglas Edwards

**Mattiello Lecture
Friday, October 21**



Werner Funke

**"Microgels—Intramolecularly Crosslinked Macromolecules:
Potent Components of Organic Coatings"
Prof. Dr. Werner Funke**

Professor Doctor Werner Funke, Professor for Polymer Chemistry at the University of Stuttgart, West Germany, is a well-known lecturer at international events. Credited with many contributions to polymer science and industry, including the nonstatistical distribution of crosslinks in polymer networks prepared by polymerization of higher-functional monomers as divinyls and diacrylates and the preparation and characterization of crosslinked macromolecules, his areas of research in the paint and coatings field have centered on the structure and properties of paint films; film formation; permeability; and properties of high solids and water-based coatings. Prof. Dr. Funke has authored over 165 publications and has studied and lectured, upon special invitation, in India, the U.S.S.R., Japan, and China. He is Managing Editor of the international journal, *Progress in Organic Coatings*.

Polyurethane Oligomers for Water-Borne And High Solids Coatings

Werner J. Blank
King Industries, Inc.*

Properly designed polyurethane oligomers offer a combination of properties including high hydrolytic stability, excellent exterior durability, hardness, and flexibility not obtained with other polymers. We have prepared a polyurethane oligomer which is soluble in a wide range of polar solvents and in water, while being compatible with acrylic, polyester, and amino high solids resins. The advantages of using a low molecular weight urethane oligomer as a polymer modifier are increased application solids, higher film hardness, and, for some systems, improved flexibility. The properties of this oligomer in water-borne and high solids coatings as a modifier for other polymer systems will be described.

INTRODUCTION

In formulating high solids coatings, it is especially difficult to balance the need for high solids content and low application viscosity. Polymer design and the choice of crosslinking agent have an overriding effect on the application solids of a coating system.

The traditionally effective means of increasing the solids content of a coating, such as decreasing the glass transition temperature (T_g) of a polymer or reducing the molecular weight, are only conditionally acceptable because they also tend to have an adverse impact on film properties.

Lowering the T_g of a polymer will reduce the hardness of a coating film and also reduce environmental resistance properties. Therefore, the composition of a polymer, its molecular weight, T_g , and functionality have to be carefully balanced to achieve the maximum solids

content without a sacrifice in properties. Often more expensive synthesis techniques, such as narrowing the molecular weight distribution, are required.

Narrow molecular weight polyester resins have been described by Calbo.¹ Although these low molecular weight resins give excellent hardness and flexibility characteristics, the ester linkages in the backbone make them sensitive to hydrolysis.

Polyether resins, based on co-reaction products of bisphenol A and either ethylene oxide or propylene oxide, have been previously described by this author.² These oligomers give a good combination of flexibility and hardness, but they are deficient in adhesion to metal substrates and their films have poor exterior durability.

Recently, novel acrylic polymerization techniques have been developed that permit the design of narrow molecular weight acrylic polymers by a group transfer polymerization process,³ as shown by Webster, et al. We studied the performance of low and narrow molecular weight polyurethane oligomers as modifiers for other crosslinkable polymers to raise the application solids and to modify the coating's performance.

Many approaches have been taken to combine or alloy polymers of different composition to obtain either completely compatible or two-phase systems. The initially rather pessimistic outlook by Scott⁴ on finding compatible polymer blends has given way to more optimism on blending as additional compatible blends have been found and other approaches to blending have been developed.

From a practical standpoint, for a polymer blend to develop useful properties, it is not essential that the blend be truly compatible. Rather, at some level the two components must have good interfacial adhesion.

Another approach taken to achieve useful blends has been the preparation of interpenetrating networks (IPN).

The coating industry has practiced the blending of polymers of different composition for many years. One of the major reasons for the widespread use of blends in

Presented at the Water-Borne and Higher Solids Coatings Symposium, in New Orleans, LA, on February 5, 1988.

*Science Rd., Norwalk, CT 06852.

Table 1—Solubility of Urethane Diol

Soluble	Solubility Parameter δ MPa ^{1/2}				
	δ_t	δ_d	δ_p	δ_h	
Methanol	yes	29.7	11.6	13.0	24.0
Ethyl acetate	yes	18.2	13.4	8.6	8.9
Butyl acetate	yes	17.8	14.5	7.8	6.8
Acetic acid	yes	26.1	13.9	12.2	18.9
Ethylene glycol	yes	34.9	13.0	15.1	29.8
Xylene/methanol 80/20	yes	23.1	14.3	9.7	11.5
Xylene/methanol 90/10	no	21.0	15.3	8.7	7.6
Toluene	no	18.3	16.4	8.0	1.6
Heptane	no	15.3	15.3	0.0	0.0

Solubility Parameter (according to Hansen)¹¹. To obtain the more familiar values of δ in (cal/cm³)^{1/2} a conversion factor of 1 MPa^{1/2} = 2.045 (cal/cm³)^{1/2} has to be used.

δ_t = total solubility parameter; δ_d = dispersion or London forces; δ_p = polar interaction; and δ_h = hydrogen bonding.

coatings is the low molecular weight of the polymers before crosslinking facilitates compatibility, thus making the design of a new polymer superfluous.

This paper reports on the compatibility and properties of a low molecular weight polyurethane oligomer with low molecular weight high-solids solvent soluble acrylic and polyester resins and the use of this urethane diol as a modifier for water-borne emulsions and solution coatings. The blends of the urethane diol with other resins can be crosslinked without any observable phase separation with either alkoxymethyl melamine or isocyanate crosslinkers.

EXPERIMENTAL

A typical process for the preparation of a urethane diol consists of the reaction of a diisocyanate such as a blend of 2,2,4-trimethylhexamethylene diisocyanate and 2,4,4-trimethylhexamethylene diisocyanate or 3-isocyanatomethyl-3,5,5-trimethylcyclohexyl isocyanate with an excess of a diol. By using a blend of isocyanates and diols, the typical problem of crystallization has been mini-

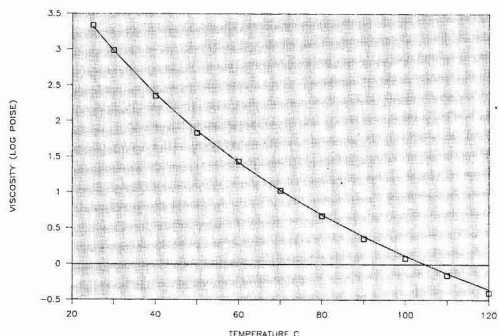


Figure 1—Viscosity vs temperature of urethane diol. □—measured data points. Calculated curve using WLF equation (2)

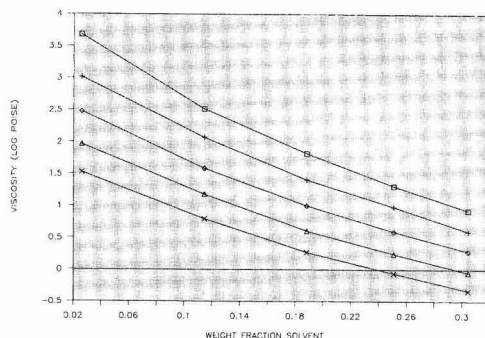


Figure 2—Dilution of urethane diol / HMMM blends. Solvent: 2-methoxypropyl acetate. Urethane diol / HMMM weight ratio: □—100/0, +—75/25, ◇—50/50, △—25/75, X—0/100

mized. The excess diol can be removed either by extraction or distillation.

The urethane diol used in our study was a proprietary product.

Characteristics of the Urethane Diol

Appearance	Viscous clear liquid
Hydroxyl number	350
Nonvolatile 60 min at 110°C, %	97.5
Viscosity at 25°C, mPa.s	214000
Solubility parameter δ (MPa ^{1/2})	26.3
M_w/M_n	1.0-1.1
Weight loss 60 min at 120°C, %	<0.8

Viscosity of the Urethane Diol

The viscosity of the urethane diol was determined over a temperature range of 25-120°C using a Brookfield model DV-II digital viscosity meter.

Solubility Parameters of Urethane Diol

The solubility parameters of the urethane diol were determined at a solids content of 10%, and are given in Table 1.

Compatibility with Other Polymers

The compatibility of the urethane diol was tested with other polymers at a weight ratio of 50/50. The polymer blend was heated to about 50-60°C to facilitate mixing. Compatibility was tested at higher temperature and also at room temperature several hours after mixing.

Polymer blends with the urethane diol were made at different weight ratios and the blends were diluted with solvents. The viscosity of the mixtures was measured over a range of weight solids.

Urethane Diol as a Cosolvent

To determine the ability of the urethane diol to act as a cosolvent in water-borne coatings, a commercially available low molecular weight polyester resin was blended with the urethane diol at different weight ratios, and the blend was titrated with water to a haze formation. Com-

Table 2—Compatibility of Urethane Diol

Type Backbone Polymer	OH Number	COOH Number	Compatibility
<i>Solvent soluble</i>			
Acrylic resin 1	86	25	PC ^a
Acrylic resin 2	86	0	PC
Polyester resin 1	235	0	C
Polyester resin 2	225	<1	C
Polyester resin 3	160	<5	C
Polyester resin 4	220	1	C
Bisphenol A-glycidyl ether	—	—	I
<i>Water soluble-dispersible</i>			
Acrylic emulsion	—	—	C
Acrylic hydrosol resin	—	—	C
Acrylic solution	—	110	C
Polypropylene glycol	280	0	C
	56	0	I
Melamine resin HMMM	—	—	C
partial methylated	—	—	C

(a) Key: C—Compatible; PC—Partially compatible, compatible hot and after dilution with solvent; and I—Incompatible.

parative tests were conducted with alcohols and glycol ether as a cosolvent.

Coating Formulations

The urethane diol was used as a sole binder and as a modifier for high solids solvent-borne acrylic and polyester resins in both melamine and isocyanate crosslinked coating systems. In addition, water-borne coatings were formulated using the urethane diol as a modifier for acrylic emulsions and also for polyester resins. When using the urethane diol as a cosolvent, it was possible to formulate high solids water-borne coatings which did not require any amine for the solubilization of the resin.

RESULTS

Solubility

The solubility parameter of the urethane diol was estimated using an additive approach of calculating the energy of vaporization and molar volume according to Fedors.⁵ Due to the complex interaction between functional sites, it was not possible to accurately calculate the hydrogen or polar interaction in the diol. The urethane diol is soluble in most polar organic solvents and water, but not in aromatic and aliphatic hydrocarbons. A solvent with the ability to form hydrogen bonds is usually the most effective in reducing the viscosity. The results of the solubility study are shown in Table 1.

Compatibility

The urethane diol is compatible with high solids acrylic and polyester resins at a weight ratio of 50/50. With some acrylic resins, there was limited compatibility with the neat resin solution, but excellent compatibility was observed in diluted form and in the film. With low molecu-

lar weight bisphenol glycidyl epoxy resins, the urethane diol is not compatible in the absence of a curing agent. However, the urethane diol was soluble in the polyamideamine resin (Table 2).

Viscosity of Blends

The viscosity of a polymer melt or an oligomer is related to the glass transition temperature (T_g) of the polymer. As shown in a simplified form of the Williams, Landel, and Ferry (WLF) equation,⁶

$$\log \eta = \log \eta_{T_g} - \frac{A(T - T_g)}{B + (T - T_g)} \quad (1)$$

Hill⁷ and Wicks⁸ have shown that the form of the WLF equation using universal constants as proposed by Nielsen⁹ can be used to calculate the viscosity of oligomers.

$$\log \eta = 13 - \frac{17.44(T - T_g)}{51.6 + (T - T_g)} \quad (2)$$

Although these constants are not truly universal constants, they can be used for many oligomers with some modification to relate viscosity as a function of temperature and of the T_g of the oligomer. The viscosity of oligomers follows equation (2).

Good correlation of this equation (2) with experimental data over a temperature range of between 25–120°C was found (Figure 1).

Hill⁷ has used equation (3) in combination with the WLF equation (2) to calculate the viscosity of oligomers.

$$T_g = C_0 + C_1 W_s \quad (3)$$

C_0 represents the T_g of the oligomer. For a series of solvents, the C_0 should therefore be constant.

A more accurate method to calculate the T_g value of a polymer and the viscosity of an oligomer solution has been developed by Wicks.⁸ He used a modification of the Fox equation¹⁰ in combination with equation (2) to calculate the T_g of acrylic oligomer solutions.

WERNER J. BLANK received his B.S. Degree in Chemistry in his native city of Vienna, Austria. He was previously associated with Farbwerke Hoechst, in Frankfurt, Germany, and Peter Stoll Lackfabrik, in Austria. He joined American Cynamid Company in 1965 where he held various research assignments in the coating and water-soluble polymer areas. In 1986, Mr. Blank joined King Industries with the responsibility for developing products for the coating and corrosion inhibitor industries. Mr. Blank holds numerous patents on electrocoating resins, crosslinking agents, and water-soluble polymers. He has extensively published and lectured on amino resins chemistry, water-soluble polymers, and high solids coatings. In 1981, he presented the Joseph J. Mattiello lecture on "Amino Resins in High Solids Coatings," at the 59th Annual Meeting of the Federation of Societies for Coatings Technology, in Detroit, MI.



Table 3—Viscosity of Urethane Oligomer in Solvents

Solvent	$T_{gs} = C_o + C_1 W_s$ eq. (3)		r^2
	C_o	C_1	
2-methoxypropyl acetate	248.9	-203.4	0.9997
2-methoxypropanol	246.8	-219.7	0.9985
Water	235.0	-276.9	0.9861

 r^2 = correlation coefficient.**Table 4—Viscosity of Urethane Diol—HMMM Blends**

Urethane Diol	HMMM	$T_{gs} = C_o + C_1 W_s$ eq. (3)		r^2
		C_o	C_1	
100	0	248.9	-203.4	0.9998
75	25	239.8	-207.4	0.9991
50	50	230.2	-217.0	0.9999
25	75	220.7	-232.6	0.9997
0	100	210.7	-246.7	0.9998

 r^2 = correlation coefficient.**Table 5— T_g of Urethane Diol—HMMM Blends**

Urethane Diol	HMMM	T_g^a °K Dil ^a	T_g^b °K Fox ^b	T_g^c °K Fox Mod	T_g^c °K Blend ^c
100	0	248.9	248.9	248.9	249.4
75	25	239.8	238.1	239.6	239.3
50	50	230.2	228.2	230.2	229.1
25	75	220.7	219.1	220.6	218.9
0	100	210.7	210.7	210.7	208.7

(a) T_g values of the blend calculated by regression analysis from the solvent dilution data.(b) T_g value of the blend calculated using the simple Fox equation. Fox equation modified (a) used for the calculation. ($k = 0.00015$).(c) T_g values from viscosity measurements of the blend urethane diol/HMMM.**Table 6—Dilution of Urethane Diol/Polyester Blend, Solvent 2-Methoxypropanol**

Urethane Diol	Polyester ^a	$T_{gs} = C_o + C_1 W_s$ eq. (3)		r^2
		C_o	C_1	
100	0	246.8	-219.8	0.9985
75	25	242.4	-216.3	0.9993
50	50	236.0	-214.1	0.9995
25	75	228.8	-209.1	0.9991
0	100	224.0	-209.9	0.9995

(a) Narrow molecular weight polyester resin with hydroxyl number of 235 and average molecular weight of 476.

$$\frac{1}{T_g} = \frac{W_s}{T_{gs}} + \frac{W_o}{T_{go}} = k_3 W_s W_o \quad (4)$$

 W_s = weight fraction of solvent, W_o = weight fraction of oligomer, T_{gs} = glass transition temperature of solvent, T_{go} = glass transition temperature of oligomer, and k_3 = constant.

The major drawback with this equation as found by Wicks is that many solvents crystallize far above the T_g and therefore it is not possible to obtain reliable constants for many solvents.

We determined that equation (3) gives satisfactory results for most blends in predicting the viscosity of the urethane diol in a variety of solvents. We obtained high correlation between experimental and calculated data as shown in the linear regression analysis of viscosity data over a weight fraction of solvent range from 0.0 to 0.4 in Table 3.

A typical problem encountered in obtaining reliable T_g or C_o values for an oligomer is the difficulty in removing the last traces of solvents from an oligomer, thus determining the solids content reliably. Trace amounts of solvent have a significant effect on the T_g of an oligomer and can therefore substantially change the values obtained in this equation. This problem can be reduced by using a minimum amount of solvent, about 5%, for all viscosity measurements, and not attempting to obtain viscosity measurements close to 100% solids content.

The major application of the urethane diol is in blends with other resins. Such systems are therefore at least three component systems which consist of a polymer, the urethane diol, and at least one other solvent. We were interested in determining to what extent the viscosity behavior of these systems can be analyzed with existing equations.

The viscosity of the three component blends of the urethane diol with hexamethoxymethylmelamine resin (HMMM) and with 2-methoxypropyl acetate as a solvent is shown in Figure 2.

Linear regression analysis of the viscosity data assumed the blend of the urethane diol with the HMMM to be a separate resin resulting in a high correlation of actual measured data and calculated values. Table 4 gives the results of the regression analysis. As seen in this table, the C_o values decrease with increasing levels of the melamine resins. These C_o values should be identical to the T_g values of the blend. In this table, we also give the C_1 values for different blends of the urethane diol and HMMM using 2-methoxypropyl acetate as a solvent. The C_1 values increase with higher melamine concentration indicating faster reduction in viscosity. C_1 values do not change linearly with HMMM concentration but rather follow the same pattern as the T_g values in the modified Fox equation.

We therefore calculated the T_g of the polymer blend using the unmodified Fox equation. These results are shown in Table 5. The T_g values for the urethane diol and the HMMM resin were obtained from regression analysis of solvent reduction curves of the urethane diol and the melamine resin.

The Fox equation produces lower T_g values for the blend than our experimental data. Using the modified Fox

Table 7— T_g of Urethane Diol/Polyester Blends

Urethane Diol	Polyester ^a	T_g °K Dil ^b	T_g °K Fox ^c	T_g °K Fox Mod	T_g °K Blend ^d
100	0	246.8	246.8	246.8	248.1
75	25	242.4	240.7	241.4	242.3
50	50	236.0	234.8	235.8	236.5
25	75	228.8	229.3	230.0	230.0
0	100	224.0	224.0	224.0	224.9

- (a) Narrow molecular weight polyester resin with hydroxyl number of 235 and average molecular weight of 476.
- (b) T_g values of the blend calculated by regression analysis from the solvent dilution data.
- (c) T_g value of the blend calculated using the simple Fox equation. Fox equation modified (4) used for the calculation. ($k = 0.00012$).
- (d) T_g values from viscosity measurements of the blend urethane diol/polyester.

equation for the urethane diol and the melamine resin blend, we can match experimentally and calculated T_g closely.

We also show the T_g values of the blend directly obtained from viscosity measurement of the blend. These results indicate that the minimum information required in a three component blend to predict the viscosity behavior of all mixtures is the viscosity measurements on two component blends.

Figure 3 gives the viscosity of a three component blend of the urethane diol with a low molecular weight polyester resin using 2-methoxypropanol as a solvent. Regression analysis of the T_g value obtained high correlation of measured and calculated viscosity as evidenced in Table 6.

Table 7 demonstrates strong agreement of calculated T_g values obtained by different calculation methods.

In the regression analysis of the three component system, there is a definitive correlation with equation (5).

$$T_{gb} = C_0 + C_1W_1 + C_2W_2 \quad (5)$$

$$C_0 = 21.7, C_1 = 227.2, C_2 = 201.4.$$

W_1 is the weight fraction of urethane diol, and W_2 is the weight fraction of polyester resin.

A blend of the urethane diol with polypropylene glycol of molecular weight 400 using 2-methoxypropanol as a solvent has been studied. The results of the regression analysis are shown in Tables 8 and 9. This blend shows significantly different viscosity behavior.

The blend substantially deviates from the Fox equation with the T_g of the blend substantially higher than predicted values. The modification of the Fox equation (4) gives

Table 8—Dilution of Urethane Diol/PPG 400 with 2-Methoxy Propanol

Urethane Diol	PPG 400 ^a	C_0	C_1	r^2
100	0	247.9	-232.0	0.9916
75	25	226.4	-201.9	0.9964
50	50	204.0	-190.2	0.9986
25	75	177.1	-170.6	0.9986
0	100	146.2	-127.7	0.9822

- (a) Polypropylene glycol MW 400.

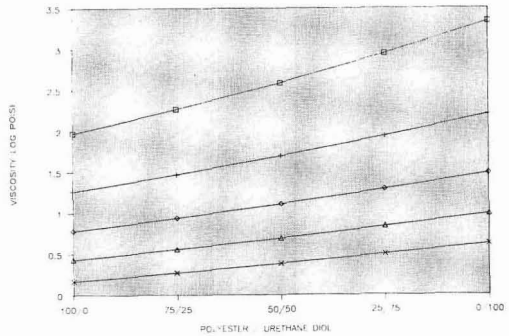


Figure 3—Viscosity of low molecular weight polyester resin blend with urethane diol. Solvent: 2-methoxypropyl acetate. □—98% solids, +—90% solids, ◇—83% solids, Δ—77% solids, and x—72% solids

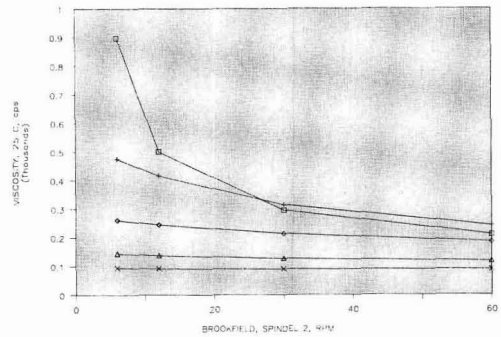


Figure 4—Viscosity of acrylic emulsion urethane diol blend at different shear rates: □—no urethane diol modification, +—10% urethane diol on binder, ◇—20% urethane diol, Δ—30% urethane diol, and X—40% urethane diol. Solids of modified systems. 47.3% at 0% urethane diol modification. 49.6% at 10% urethane diol modification. 52.5% at 20% urethane diol modification. 55.1% at 30% urethane diol modification. 58.4% at 40% urethane diol modification

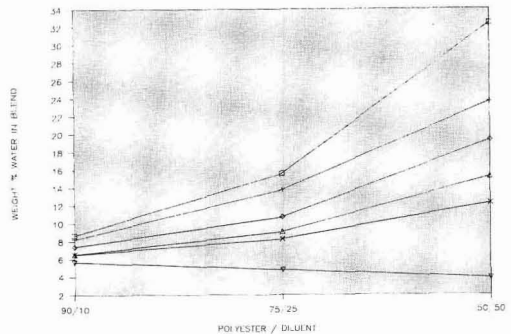


Figure 5—Water dilution of narrow molecular weight polyester resins with different cosolvents. □—ethanol, +—methanol, ◇—2-butoxy ethanol, Δ—urethane diol, X—2-ethoxyethoxy ethanol, ▽—ethylene glycol

Table 9— T_g of Urethane Diol/PPG 400 Blend

Urethane Diol	PPG 400	T_g^a °K Dil ^a	T_g^b °K Fox ^b	T_g^c °K Fox Mod	T_g^c °K Blend ^c
100	0	247.9	247.9	247.9	253.9
75	25	226.4	211.2	226.2	228.5
50	50	204.0	183.9	203.9	203.1
25	75	117.1	162.9	177.9	177.7
0	100	146.2	146.2	146.2	152.0

(a) T_g values of the blend calculated by regression analysis from the solvent dilution data.
 (b) T_g value of the blend calculated using the simple Fox equation. Fox equation modified (4) used for the calculation, ($k = -0.002$).
 (c) T_g values from viscosity measurements of the blend urethane diol/polypropylene glycol.

Table 10—Solubility Parameter of Co-Solvents

	Solubility Parameter δ MPa ^{1/2}			
	δ_t	δ_d	δ_p	δ_h
Ethanol	26.1	12.6	11.2	20.0
Methanol	29.7	11.6	13.0	24.0
2-butoxy ethanol	20.2	13.3	7.9	13.0
2-ethoxyethoxy ethanol	21.2	13.0	8.9	13.0
Ethylene glycol	34.9	10.1	15.1	29.8

Solubility Parameter (according to Hansen)¹¹. To obtain the more familiar values of δ in (cal/cm³)^{1/2} a conversion factor of 1 MPa^{1/2} = 2.045 (cal/cm³)^{1/2} has to be used.
 δ_t = total solubility parameter; δ_d = dispersion or London forces; δ_p = polar interaction; and δ_h = hydrogen bonding.

Table 11—High-Solids Acrylic Resin HMMM Crosslinked

	Parts Per Weight			
Acrylic resin ^a	675.6	595.1	439.8	297.9
Urethane diol	0.0	58.6	167.1	264.1
HMMM ^b	129.3	161.3	219.4	270.7
Blocked catalyst ^c	12.7	13.1	13.7	14.2
Xylene	141.9	133.5	123.8	118.1
Methanol	35.5	33.4	31.5	30.5
Flow control agent ^d	5.0	5.0	4.7	4.5
TOTAL	1000.0	1000.0	1000.0	1000.0
Solids, calc, %	63.7	65.7	69.0	71.6
Viscosity, 25°C, cps	501	500	500	500

Film properties:
 Substrate: Bonderite^e 1000 CRS
 Cure schedule: 20 min at 120°C

Film thickness, mil	1.0	1.0	1.0	1.0
Pencil hardness	F-H	F-H	H-2H	H-2H
Knoop hardness	10.1	12.7	17.0	16.9
Impact resistance				
reverse, in. lb	5-10	10-20	10-20	20-30
front in. lb	50-60	40-50	40-50	60-70
Salt spray 100 hr, creepage, mm	5	8	12	12
Cleveland humidity				
60°C, 250 hr	F-H, 9F	HB-F, 9D	B-HB, 9D	B-HB, 9D
Crosshatch adhesion, %	100	100	100	100

(a) Acryloid AT-400—Rohm and Haas Co., Philadelphia, PA.
 (b) Cymel 303 resin—American Cyanamid Co., Wayne, NJ.
 (c) Nacure 5225—King Industries, Inc., Norwalk, CT.
 (d) Dislon L-1980—Kusumoto Chemical Co., Distributor King Industries, Inc., Norwalk, CT.
 (e) Bonderite is a registered trademark of Parker Rust Proof Co., Detroit, MI.

excellent agreement with experimentally determined values. Linear regression analysis on the viscosity data of the blend of urethane diol-polypropylene glycol shows too high a T_g value for the urethane diol and the polypropylene glycol itself which is due to the significant deviation of the T_g from linear behavior.

The urethane diol has been tested as a reactive diluent for acrylic emulsions. A commercially available acrylic emulsion which is reactive with melamine resins has been blended with the urethane diol. Addition of the urethane diol as a 90% solution in water was used. The viscosity of the blend was measured on a Brookfield viscosity meter at different shear rates. Figure 4 gives the viscosity measurement as a function of RPM. Addition of the urethane diol changes the rheology of the emulsion from a non-Newtonian to a Newtonian flow behavior. The application solids is raised and the viscosity is reduced. There is no indication of swelling of the emulsion particle with the emulsion tested.

Table 12—High Solids Acrylic Resin Isocyanate Crosslinked

	Parts by Weight	
Acrylic resin ^a	654.1	568.5
Urethane diol	—	45.8
Isocyanate crosslinker ^b	156.5	194.4
2-methoxypropyl acetate	160.0	161.7
MIBK	24.0	24.0
Dibutyltin dilaurate 10% in MIBK	2.7	2.8
Ca octoate 5%	2.7	2.8
TOTAL	1000.0	1000.0
Solids, calc, %	53.6	55.8
Viscosity, 25°C, cps	659	650

Film properties:
 Substrate: Bonderite 1000 CRS
 Cure schedule: 24 hr at 25°C

Film thickness, mil	1.0-1.1	1.0-1.1
Pencil hardness	HB-F	HB-F
Knoop hardness	4.0	2.5
MEK double rubs	35	40
Impact resistance		
reverse, in. lb	>160	>160
front, in. lb	>160	>160

Cure schedule: 168 hr at 25°C

Pencil hardness	H-2H	H-2H
Knoop hardness	10.8	17.2
MEK double rubs	>100	>100
Impact resistance:		
reverse, in. lb	>160	>160
front, in. lb	>160	>160

Cure schedule: 20 min at 100°C

Hr aged at 25°C	0	168	0	168
Pencil hardness	H-2H	H-2H	H-2H	H-2H
Knoop hardness	12.9	16.3	15.1	20.8
MEK double rubs	40	>100	50	>100
Impact resistance:				
reverse, in. lb	120-130	20-30	10-20	5-10
direct, in. lb	150-160	100-110	50-60	30-40
Cleveland humidity				
60°C, 500 hr	HB-F/9D	H-2H/9VF	H-2H/9VF	H-2H/9VF

(a) Acryloid AU-608S—Rohm and Haas Co.
 (b) Desmodur N-3390—Möbyac Corp., Pittsburgh, PA.

Table 13—Water Dispersed Emulsion System

	Parts by Weight		
Acrylic emulsion ^a	44.4	29.5	19.9
Urethane diol	0.0	6.0	12.2
Acrylic resin ^b	5.8	6.5	8.0
HMMM ^b	2.1	5.5	9.3
Titanium dioxide ^c	20.4	22.8	27.8
Dimethylethanolamine	0.6	0.5	0.4
2-propoxy propanol	2.2	2.1	2.2
Water	24.5	27.1	20.2
TOTAL	100.0	100.0	100.0
Solids, calc., %	47.5	52.2	63.1
Viscosity, 25°C, cps	156	68	585
Pigment vol. conc., %	18.1	18.3	18.5
Cure schedule: 20 min at 135°C			
Film thickness, mil	1.25	1.25	1.25
Gloss, 60°/20°	57/14	68/20	83/47
Pencil hardness	HB-F	F-H	H-2H
Knoop hardness	5.6	11.0	14
Impact resistance			
reverse in. lb	160	160	160
direct in. lb	160	160	160
Crosshatch adhesion, %	100	100	100
Conical mandrel, 1/8"	pass	pass	pass
T-bend, aluminum	T-2	T-3	T-4

(a) Ucar 462 vehicle—Union Carbide Corp., Danbury, CT.

(b) Acryloid WR-97—Rohm and Haas Co.

(c) Cymel 303 resin—American Cyanamid Co.

(d) Ti-Pure 960—E.I. du Pont de Nemours & Co., Inc., Wilmington, DE.

Urethane Diol as a Cosolvent

Many water dispersible resins use cosolvents such as glycol ether solvents to improve the solubility and flow behavior of a coating. The use of the urethane diol as a cosolvent in melamine resin crosslinked coatings has the advantage of eliminating volatile organic components. In emulsion coatings, the urethane diol can act as a coalescing agent and a binder for the pigment, resulting in higher gloss and, because of the higher crosslink density, an increased chemical resistance and hardness.

To demonstrate the solubilizing characteristics of the urethane diol in water-borne coatings, we measured the water take-up of a polyester resin diluted with different amounts of cosolvent.

The results of this test are shown in *Figure 5*. In the high-solids polyester resin selected for this study, the urethane diol acts as a cosolvent with a solubility characteristic between 2-ethoxyethoxy-ethanol and 2-butoxy ethanol. Solubility parameters of cosolvents tested are shown in *Table 10*.

Formulations

In a high solids acrylic resin/HMMM crosslinked coating, modification with the urethane diol results in a significant increase in application solids and film hardness with some reduction in adhesion and corrosion resistance, which is not surprising in a highly melamine crosslinked film (*Table 11*).

The urethane diol can be used to modify isocyanate crosslinked formulations. The formulation utilizes an aliphatic triisocyanate crosslinker for low temperature cure.

Table 14—High Solids Water-Borne Coating

	Parts by Weight	
Polypropylene glycol MW 400	1.8	
Water soluble acrylic ^a	6.4	
Polyester ^b	10.5	
Urethane diol	11.7	
HMMM ^c	13.1	
Blocked acid catalyst ^d	0.7	
Silicone surfactant ^e	0.03	
Titanium dioxide ^f	31.2	
Dimethylethanolamine	0.3	
2-Methoxypropanol	11.7	
Water	12.6	
TOTAL	100.0	
Solids, 20 min at 150°C, %	71.0	
Viscosity, cps	197	
Substrate: Bonderite 1000 CRS		
Cure schedule: 20 min at 150°C		
Film thickness, mil	1.25	
Gloss, 60°/20°	85/63	
Pencil hardness	H-2H	
Knoop hardness	13.2	
Impact resistance		
reverse in. lb	160	
direct in. lb	160	
Salt spray 250 hr, creepage	6 MD, 0.5 mm	
Crosshatch adhesion, %	100	

(a) Acryloid WR-97—Rohm and Haas Co.

(b) K-FLEX 188—King Industries, Inc.

(c) Cymel 303 resin—American Cyanamid Co.

(d) Nacure S225—King Industries, Inc.

(e) Silwet L-7600—Union Carbide Corp.

(f) Ti-Pure 960—E.I. du Pont de Nemours & Co.

The urethane diol is used as a modifier to improve hardness (*Table 12*).

We used the urethane diol in water-borne systems as a modifier for emulsions crosslinked with a melamine resin. The objective behind this modification was to obtain an improvement in rheology, increased hardness, gloss, and solvent resistance. Most acrylic emulsions crosslinked with a melamine resin give a good combination of hardness and flexibility. The modification of an acrylic emulsion with the urethane diol permits the use of acrylic emulsions with a lower T_g which are film forming in absence of a cosolvent and which obtain a high degree of hardness. A commercially available acrylic emulsion was modified with increasing levels of the urethane diol. The level of HMMM crosslinker was then adjusted to accommodate the higher level of hydroxyl groups. The system was pigmented with TiO_2 and a water-soluble acrylic resin was used as dispersant for the pigment. The amount of cosolvent was kept at a minimum. As shown in *Table 13*, the modification with the urethane diol raised the solids content of the system. In addition, hardness and gloss were improved. There was no sacrifice in impact resistance, but a decrease in T-bend on aluminum substrate was observed. The urethane diol did not alter the flash rusting tendency of the emulsion appreciably.

To explore the cosolvent properties of the urethane diol, we formulated the urethane diol with a low and narrow molecular weight hydroxyl functional polyester

resin. In absence of a cosolvent, this polyester is compatible with less than 5% water. Using the urethane diol at approximately a 1/1 level with the polyester resin, we can achieve sufficient water dilutability. To adjust the hardness for this system, we incorporated a small level of polypropylene glycol in this system (see *Table 14*).

The advantage of this approach in formulating water-borne coatings is the absence of any large levels of cosolvent and amine neutralizer.

SUMMARY

The coating industry has made significant progress to reduce the emission of organic solvents into the atmosphere. High solids coatings have been one of the major technologies which helped the industry to reduce the emission of solvents. High solids coatings, where applicable, have been incorporated in applications from sophisticated and very demanding end uses such as automotive topcoats to less demanding general industrial applications. For spray applications on existing equipment or in end uses where a minimum of capital outlay is planned, high solids coatings have been the technology of choice.

Many of the present high solids resins in use are based on technology evolved from low solids technology. Further progress along these lines is limited, and the next generation of resins have to follow new concepts to offer any substantial improvements.

There is a special need for a low temperature cure mechanism which neither utilizes nor emits toxic compounds and does not depend on polar hydrogen bonding

reactive sites. In addition, polymer synthesis methods have to be developed which result in narrow molecular weight distribution polymers.

ACKNOWLEDGMENT

I would like to acknowledge the experimental work of Mr. T. Cole and thank King Industries, Inc., for permission to publish this work, and Mrs. B. Rizza and Mr. R. Burk for their assistance in preparing this paper.

References

- (1) Calbo, L.J., *Proceedings of the 13th Annual Water-Borne and Higher Solids Coatings Symposium*, p. 356 (1986).
- (2) Blank, W.J., "New Approach to Formulation of Water-Borne Coatings," *JOURNAL OF COATINGS TECHNOLOGY*, 49, No. 631, 46 (1977).
- (3) Webster, O.W., Hertler, W.R., Sogah, D.Y., Franham, W.B., and RajanBabu, T.V., *J. Macromol. Sci.-Chem.*, A21 (8 & 9), 943-960 (1984).
- (4) Scott, L.J., *J. Chem. Phys.*, 17, 279 (1949).
- (5) Fedors, R.F., *Polymer Eng. Sci.*, 14, No. 2, 147 (1974).
- (6) Williams, M.L., Landel, R.F., and Ferry, J.D., *J. Am. Chem. Soc.*, 77, 3701 (1955).
- (7) Hill, L.W., Kozlowski, K., and Sholes, R.L., "Theory and Practice of Viscosity Reduction in High Solids Systems," *JOURNAL OF COATINGS TECHNOLOGY*, 54, No. 692, 67 (1982).
- (8) Wicks, Z.W. Jr., Jacobs, G.F., Lin, I-C., Urruti, E.H., and Fitzgerald, L.G., "Viscosity of Oligomer Solutions," *JOURNAL OF COATINGS TECHNOLOGY*, 57, No. 725, 51 (1985).
- (9) Nielsen, L.E., "Polymer Rheology," Marcel Dekker, pp. 33, 74, and 133, 1977.
- (10) Fox, T.G., *Bull. Am. Phys. Sci.*, 1, 123 (1956).
- (11) Hansen, C.M., "Three Dimensional Solubility Parameter—Key to Paint Component Affinities. I," *JOURNAL OF PAINT TECHNOLOGY*, 39, No. 505, 104 (1967).

Comparison of Volatile Organic Content (VOC) And Volatiles Released from a Melamine Crosslinked High-Solids Polyester

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Northwestern Society Technical Committee

Measurements of volatile organic compounds released when a melamine crosslinked polyester is cured at different temperatures were compared with those released using the EPA recommended procedure for volatile organic content (VOC). The data indicate that VOC should be measured at the application curing temperature since there is disagreement between the VOC determined at higher applied temperatures and the value based on the EPA procedure. This data will allow suppliers and users of coatings to compare coating materials on the same basis. The VOC at three cure temperatures (110, 149, and 205°C) varied from 275 to 363 g/L. Analytical techniques were employed to demonstrate that complex chemical reactions occur with the melamine cured systems as the temperature is increased, resulting in differences in the amounts of volatile materials released.

INTRODUCTION

Coatings suppliers, raw material suppliers, users, and regulatory agencies must agree upon the volatile organic content (VOC) of products to comply with EPA and state regulations for emissions. The EPA has published guidelines¹ to determine VOC. It has been the practice of many formulators to employ Method 24 (ASTM D 2369-81) that is referenced in the EPA guideline. This method is based on Procedure A (volatile content of coatings determined for 20 min at 110°C) or Procedure B (volatile content determined for 60 min at 110°C). However, the

ASTM D 2369-81 method contains a provision for single package heat-cured coatings that are commonly applied in factories to metal containers, flat (coil) metal, large appliances, and many other metal parts. It states that Procedure B is presumed applicable to most kinds of paints and related coatings intended for either ambient or baking film formation, except where substantial amounts of volatiles may be consumed or produced in chemical reactions during film formation. This provision should be exercised with melamine formaldehyde crosslinked polyester type coatings that are baked at temperatures above 110°C.

The users of such coatings that produce volatile organic compounds during the curing process are faced with the calculation of emissions that occur at significantly higher temperatures than 110°C (the temperature recommended to determine VOC) since many products do not cure or meet intended properties unless processed at higher temperatures. There is a need in the coatings industry to agree on a method for determining VOC.

An example of a class of coatings that is in this category is the melamine formaldehyde-cured polyester type coatings. Development of high-solids coatings materials that use these materials are of particular interest.

High-solids coatings are intended to minimize the emission of volatile organic compounds. The organic volatile content may be subject to interpretation, based on the method employed to determine VOC. It is uncertain whether many of these coatings comply with the claimed volatile organic content when applied at a higher temperature than employed to determine VOC. It also results in ambiguity if the total amount of volatile organic compounds emitted at the application site is to be calculated.

A melamine formaldehyde polyester system that employs a methylated type melamine and an alkyl benzene

Presented at the 65th Annual Meeting of the Federation of Societies for Coatings Technology, in Dallas, TX, on October 6, 1987.

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sulfonic acid as catalyst was chosen for this study. There are two types of methylated melamine resins, a monomeric form of hexamethoxymethyl melamine and a type that is not completely etherified.² The former type, which is relatively fully reacted with formaldehyde and almost completely methylated, theoretically cannot self-condense since there are no active hydrogen atoms remaining, although self-condensation does occur to some extent in the presence of moisture. Hill³ has reported complete co-condensation with a hexamethoxymethyl melamine and polyester system similar to the one used in this study when the reactants are present in stoichiometric amounts, limited self-condensation with excess melamine at a normal curing temperature and additional self-condensation at higher temperature. The type that is not fully etherified can self-condense at a more rapid rate.

Commercial melamine formaldehyde resins usually contain a combination of functional group types. Although monomeric hexamethoxymethyl melamine with only alkoxymethyl functional sites can be prepared, it is not possible to synthesize products that have a consistent structure if they contain alkoxy, methylol, and active hydrogen attached to the nitrogen.⁴

A literature review indicates that there can be variations in the type and amount of volatile organic compounds released from acid-catalyzed melamine reactions. The application of melamine crosslinkers to high-solids coatings has been reviewed by Bauer⁵ and Santer.⁶ Blank⁴ also has discussed the crosslinking mechanisms of melamine resins.

Bauer⁵ has indicated that fully-alkylated melamines are those where nearly all the groups (>80%) are alkoxy groups. Partially alkylated melamines contain a substantial fraction of amine and/or methylol groups. Bauer states that the reactivity of a given group depends on its neighbors.

For fully-alkylated melamines, a specific acid-catalyzed mechanism has been proposed by Blank⁴ in which the reaction is driven to completion by the volatilization

of methanol. According to Blank, the form of the rate equation that results from steady state analysis of the specific acid-catalyzed reactions depends strongly on how the concentration of methanol (in the film) varies with time, i.e., the reaction is first order only if the methanol concentration is zero.

Bauer and Budde⁷ found that the proposed equations gave good agreement with experimentally determined extents of reaction with some assumptions concerning the methanol concentration. Bauer⁵ has stated that Meijer has fitted data to an SN1 mechanism and found that the rate of methanol evaporation played a key role in the kinetics.

Santer⁶ has indicated that for most vehicles the principal reactive site is a primary or secondary hydroxyl group. Hydroxyl groups react with the amino resin by means of an etherification or transesterification process. The reaction is promoted by the addition of an acid catalyst or by acid groups (e.g., carboxyl) already present in the vehicle. Hydrolysis reactions may also occur in the uncured formulation or during cure with the formation of alcohol.

Santer⁶ revealed that hydrolysis proceeds readily under acid conditions after initial protonation of the ether oxygen in the alkoxy group. In this mechanism, proposed by Berge,⁸ the second step which results in the release of methanol is rate-determining and is dependent on the concentration of the protonated intermediate.

Koral, et al.,⁹ studied fully alkylated melamine formaldehyde resins which require a strong acid catalyst such as p-toluene sulfonic acid. The proposed reaction pathway results in the formation of a carbonium ion which can either recombine with the split off alcohol or react with functional groups on a polymer. Most methanol collected as volatiles⁴ can be accounted for as a product of the crosslinking reaction; any excess methanol must come from the hydrolysis of melamine.

Blank⁴ also reported that partially butylated and methylated melamine formaldehyde resins emit the largest level of formaldehyde during cure, fully methylated emit less, and highly methylated NH resins emit the least. J. van Zuylen¹⁰ reported that reactivity increases with a decreasing amount of $-NCH_2OR$ group present based on the study of alkyd melamine formaldehyde curing systems. "Low reactive" melamine resins show a lower extent of self-condensation than "high reactive" resins at about the same extent of co-condensation with alkyd resins. At 110°C, more cure is obtained with the highly reactive resin, whereas at 150°C, the low reactive melamine formaldehyde resin has the higher degree of cure. Studies that are valid only for resin combinations which do not contain a strong acid catalyst showed that co-condensation of completely etherified melamine formaldehyde resins with alkyd resins take place at a measurable rate at temperatures in excess of 150°C. In the presence of a strong acid catalyst, the co-condensation with hydroxyl groups is many times faster than self-condensation.^{9, 10}

Nonvolatile determinations of amino polymers made at 60°C in a vacuum oven are much closer to the true polymer contents than those made at higher temperatures according to Secrest.¹¹ Infrared spectra reveal a continuous loss of ether groups and methylol groups with a

Table 1—Composition of the Polyester-Melamine High-Solids Coating Formulated to Evaluate VOC Procedures

Component	Weight %
Polyester resin ^a	39.70
Melamine crosslinker ^b	11.23
Titanium dioxide pigment ^c	35.97
Alkyl benzene sulfonic acid catalyst ^d	0.48
Stabilizer ^e	0.17
Solvent ^f	12.45
	100.00

(a) Cargill 5770 is currently available as 5776.
 (b) Resimene 747 is a registered trademark of Monsanto Co.
 (c) R-900 is a registered trademark of DuPont Co.
 (d) Catalyst 600 is a registered trademark of American Cyanamid Co.
 (e) Amp-95 (2-amino-2-methyl-1-propanol) is a registered trademark of Angus Chemical Co.
 (f) PM Acetate (propylene glycol monomethyl ether acetate) is a registered trademark of Dow Chemical Co.

melamine formaldehyde resin formulation dried at 105°C. Resins dried at 60°C reveal that the loss of ether and methylol groups is very small after three hours dry time.

Sharp and Wright¹² investigated the discrepancies in the determination of solids content of baking enamels crosslinked with nitrogen resins. The thermal stability of individual nitrogen and plasticizing resins, as well as mixtures of these resins, was examined. They reported that the chemical reactions which occur during the solids determination (120°C / 30 min and 160°C / 10 min) relate to the solids discrepancies. They showed that plots of solids difference vs resin composition correlate with variations in hardness and flexibility characteristics of the cured films.

EXPERIMENTAL

Materials

The coating material was formulated with a commercial polyester (Cargill 5770 currently available as Cargill resin 5776) and hexamethoxymethyl melamine (Resimene[®] 747) in a PM acetate (propylene glycol monomethyl ether acetate) solvent with an alkyl benzene sulfonic acid catalyst and titanium dioxide pigment as shown in Table 1. The Cargill 5770 oil free polyester resin was supplied in PM acetate solvent (11.9 kg neat resin blended with 2.1 kg PM acetate) rather than ethylene glycol monoethyl ether. The hydroxyl and acid values of the polyester are 178 and 6.64 mg KOH / g and the equivalent weight is 315 g / equiv. The solids level of the prepared polyester is 82.1%. The cure conditions recommended by the manufacturer of the polyester for this coating at this catalyst level is 20 min at 149°C. The coatings were applied on Bonderite[®] 1000 substrates with a wire wound #34 rod and cured with a gas fired oven to obtain a dry film thickness of 1 mil ± 0.1 mil. No flash procedure was used and the coated panels were held at room temperature for less than five minutes before baking.

Bonderite is a registered trademark of Parker Rust Proof Co.

Formula parameters and the measured physical properties of the coating are summarized in Table 2.

Gas Chromatography Procedures

Headspace gas chromatography experiments were conducted with weighed samples of the wet coating placed in one pint Mason jars that were subsequently heated at 110°C, 149°C, and 205°C. Calibration mixtures contained varying ratios of PM acetate/methanol (95/5, 90/10, 80/20, 75/25, 60/40, and 50/50). Aliquots (50 µL) of the headspace were injected into the gas chromatograph. The calibration mixtures were prepared so that the total amount of PM acetate, plus methanol that was weighed into the Mason jars, was similar to the amount of PM acetate contained in the coating samples, that were also weighed into the Mason jars to measure the volatiles released.

Injections of the headspace vapors were made at each of the experimental temperatures after heating the coating samples for 20, 40, and 60 min. The heated Mason jars (fitted with a septum in a specially designed lid to sample the headspace) with the coating samples were returned to the oven without being allowed to cool for more than 1-2 min when sampled. The gas chromatography conditions were selected to measure the methanol peak vs the PM acetate peak as internal standard as shown in Table 3A and similarly for measurement of water vapor using packed columns.

Gas chromatography headspace analysis with mass spectral detection (70 electron volts) was conducted with a 60 m DB-5 capillary column (0.25mm id, 0.25 µm film thickness) and employed a Hewlett-Packard 5985B Gas Chromatograph / Mass Spectrometer with a scan range of 15-350 atomic mass units (amu). Headspace analysis was performed with the coating (50-100 mg) evenly smeared inside a ¼-inch test tube.

The test tube was capped with a septum and 100 µL of the headspace sample was injected with a gas-tight syringe after heating at 110°C, 149°C, and 205°C for 20 min under the conditions shown in Table 3B. The head-

Table 2—Formula Parameters and Measured Physical Properties of the Polyester-Melamine High-Solids Coating

Formula Parameter	Calculated Value
Nonvolatile matter	81.44% (based only on solvent loss)
Nonvolatile volume	71.36%
Pigment mass (wet coating)	35.96%
Pigment volume (dry coating)	12.88%
Pigment/binder (dry coating)	0.791
VOC	322.6 g/L ^a
Physical Property	Measured Value
Density	12.48 lb/gal
Viscosity (Ford #4 cup)	90 sec
Gloss (60/20)	96/78%
Hiding (No. 2 wedge, Cryptometer)	970-1078 sq ft/gal

(a) Calculated VOC includes the theoretical amount of methanol loss based on the complete co-condensation reaction.

Table 3A—Gas Chromatography Conditions Used for Packed Column-Headspace Analysis of Methanol and Water Evolved During Cure^a

	Methanol Measurement	Water Measurement
Column	0.1% SP-1000 on Carbowack C 6 ft × 2 mm, glass	Porapak QS 6 ft × 2 mm, glass
Column temperature	100°C to 190°C at 40°C/min, hold 5 min	80°C to 250°C at 20°C/min, hold 5 min
Injection port temperature (°C)	275	200
Detector type	Flame ionization detector (FID)	Thermal conductivity (TC)
Detector temperature (°C)	275	200
He flow rate (mL/min)	40	50
Injection volume	50 µL	50 µL

(a) Instrument: Perkin Elmer Sigma 2B.

space analysis was also conducted using the DB-5 capillary column and flame ionization detector.

Gas chromatography dynamic purging experiments were conducted with the coating sample (ca. 10 mg) smeared inside a 1/4-inch o.d. glass tube. The tube was then connected to the injection port of the GC/MS instrument and heated to the appropriate temperature. Helium was directed through the tube to flush volatilized materials into the injector port where they entered the column and were cryogenically trapped at 5°C. The coating was cured with this trapping configuration in place for 20 min and the column was then heated to 40°C followed by a temperature program of 8°C/min to 300°C.

Thermal Analysis

Thermogravimetric analysis (TGA) experiments were conducted with a DuPont Model 1090 Thermal Instrument and Model 951 Thermogravimetric Module. Air was used as the purge gas at a flow rate of 50 mL/min and the temperature was isothermally held at 110°C, 149°C, or 205°C. The coating also was analyzed with temperature programming at a rate of 10°C/min from 30°C to 260°C. A similar temperature program experiment was conducted with the hexamethoxymethyl melamine used to formulate the coating.

In addition, TGA experiments were conducted with a DuPont Model 1090 Thermal Instrument interfaced to a Nicolet Model 20 SXC FTIR with a Nicolet TGA flow cell operated at 230°C. Also, effluent gases from the TGA of the formulated coating (supplied as described earlier) were cold trapped in a separate experiment to collect the products evolved in the temperature range 100–250°C. The cold trapped products were evaluated with GC/FTIR in which a gas chromatograph with a DB-5 capillary column was interfaced with the Nicolet FTIR. The FTIR data was collected at 8 cm⁻¹ resolution using a TGS detector scanning at a rate of 4.44 scans/sec.

In a separate series of experiments, thermal mechanical analysis (TMA) measurements were conducted with a DuPont 1090 instrument to determine the glass transition temperatures (T_g) of the coating cured on panels at 110, 149, and 205°C for 20 and 60 min. A five gram weight and penetration probe were used, the system was cooled

to 0°C, and the temperature was programmed to 205°C at 5°C/min.

RESULTS AND DISCUSSION

Volatile Organic Content

The ASTM D 2369-81 sample handling procedure was used to determine the nonvolatile contents. However, to minimize variation with the comparison of nonvolatile contents and headspace analyses, no excess solvent was added to the coating sample. The apparent VOC was calculated for different heating times (20, 40, and 60 min) at three temperatures (110, 149, and 205°C) (Table 4). The results show a 5.0% difference in the apparent VOC determined at 205°C vs 110°C, a 4.3% difference for 205°C vs 149°C, and a 0.7% difference for 110°C vs 149°C for 60 min. The change in heating time results in differences of 2.4% between 20 min and 60 min at 110°C, 3.7% at 149°C, and 1.1% at 205°C. The differences observed in these experiments demonstrate the dependence of VOC determinations on the time and temperature at which the coating is cured.

Headspace Gas Chromatography With Packed Columns

The headspace procedure conducted with a one pint Mason jar was tested to determine whether the nonvolatile determinations agree with the ASTM D 2369-81 results. The coating samples were prepared according to the D 2369-81 procedure to determine nonvolatile contents. However, the aluminum pans containing known weights of coating material were each placed in a pre-heated

Table 3B—Gas Chromatography Conditions Used for Capillary Column Headspace Analysis And Dynamic Purging Technique with a Mass Spectrometer Or Flame Ionization Detector^a

	GC/MS	GC/FID
Column	DB-5 capillary column 60 m × 0.25 mm id 0.25µm film thickness	DB-5 capillary column 60 m × 0.25 mm id 0.25µm film thickness
Column temperature	5°C, hold 2 min, to 300°C at 8°C/min (dynamic purging 5°C trap 20 min, heated to 40°C, programmed to 300°C at 8°C/min)	5°C, hold 2 min, to 300°C at 8°C/min
Split profile	Splitless 30 sec	1:50
Injection volume	100µL	—
	Dynamic purging— flushed volatile organics into injection port after 5°C cryogenic trap for 20 min	
Mass spectral conditions	70 electron volts	—

(a) Instruments: Hewlett-Packard 5985B GC/MS; Hewlett-Packard 5890 GC/FID.

**Table 4—VOC's Determined with Modified Method
ASTM D 2369-81
(Selected Time and Temperature Conditions)**

Method ^a	Test Temp. (°C.)	VOC (g/L) ^b		
		20 min	40 min	60 min
Modified ASTM D 2369	110	275	294	303
Modified ASTM D 2369	149	284	307	312
Modified ASTM D 2369	205	351	357	363

(a) The ASTM D 2369-81 method was modified to determine nonvolatile contents without the addition of excess solvent and with the temperature changes reported in this table.
(b) VOC = $W_o - D_c / 100$ where: W_o = organic volatile content; and D_c = coating density, as supplied.

Note: The VOC calculated from the formula is 322.6 (includes theoretical methanol loss).

(110°C) one pint Mason jar and allowed a five minute heating time at 110°C.

The nonvolatile data for 20, 40, and 60 min heating times at 110°C agree within the range 1.0-1.3% with the normal ASTM D 2369-81 procedure results. This comparison of procedures indicates that the components of the headspace atmosphere are representative of the organic volatile components that are evolved with the ASTM D 2369-81 procedure.

The ASTM D 2369-81 precision requirement is 2.9% relative for the same operator on different days. The precision calculated to determine nonvolatile contents for the coating tested in this work is 0.57%. The required reproducibility between two laboratories is 4.7% and the calculated reproducibility between two laboratories for the coating tested is 0.75%.

The headspace gas chromatography experiments that were conducted at the three temperatures, 110, 149, and 205°C for 20, 40, and 60 min heating times, showed two major peaks that coincide with the retention times of methanol and PM acetate when analyzed with the 0.1% SP-1000 on Carboxpack C column.

Calculation of the precision obtained for the headspace determination of methanol is based on a series of three measurements with each of the six calibration standards (data were available for a total of nine samples during the period of experimental work). The 95% confidence interval is the percent methanol ± 0.13 percent or an error range of less than 0.3%.

The methanol loss, measured with the PM acetate peak as internal standard, is summarized in Table 5. It is assumed that at the lowest time and temperature conditions (20 min at 110°C), the PM acetate in the coating is completely volatilized. Even if this assumption is not valid, the data indicate that the apparent methanol released is at its lowest value under these conditions relative to longer heating and higher temperature conditions.

The calculated maximum amount of methanol that could be released based on the conversion of all the methoxy groups on the fully alkylated melamine is 4.5% (the actual functionality is probably less than theoretical). The methanol that would be released if complete reaction occurred with the hydroxyl groups of the polyester is calculated to be 3.3%. The evolved methanol measured with the headspace gas chromatography procedure shows a leveling off to a value of 3.0% at 110°C and 149°C for

60 min heating time and is in the range of 3.4-4.5% at 205°C for 20 and 40 min heating times.

The comparison of measured and predicted evolved methanol suggests that co-condensation occurs at moderate temperature (149°C) and that self-condensation occurs at higher temperatures (205°C). The latter is consistent with the continual weight loss observed with TGA conducted isothermally at 205°C.

The amount of methanol released for 40 min heating time at 149°C (1.9%) as shown in Table 5 may be the result of a measurement error that results from a change in the rate of volatiles evolved in that temperature range. The TGA of the coating that shows weight % vs temperature (Figure 1) contains a change in the rate of weight loss and an inflection point, which is demonstrated with a plot of the derivative curve, in the range of 150°C.

The evidence that an additional volatile component is released is supported with the FTIR spectrum obtained at 155°C with the direct TGA / FTIR interface. The spectrum shows the presence of methanol but differences in the relative intensity of a sharp band in the 1100 cm^{-1} region is consistent with the possible presence of 3-methyl-2-butanol. The latter compound (b.p. 114°C) was among the products suggested using a Nicolet computer library search with the GC / FTIR spectra obtained with the cold trapped gases collected from the TGA effluent of the polyester. It is also possible that differences in response factors may contribute to the uncertainty of the methanol released in the 150°C temperature range as measured with headspace gas chromatography.

The headspace analysis chromatograms obtained with the Porapak column showed that no measurable water is detected as a result of the curing process regardless of the time and temperature employed. Water was not detected in the TGA / FTIR evolved gases.

However, it was observed that the chromatograms obtained with the packed columns contain small peaks which indicate the presence of trace components in addition to the major peaks that are attributable to methanol and PM acetate.

High Resolution Gas Chromatography With Mass Spectral Detection

Separate experiments were performed to study the volatile products with dynamic purging GC / MS, using electron impact (EI) and chemical ionization (CI) techniques for evaluation of the peaks obtained with a DB-5 capillary column. The high resolution column enabled the separation and detection of additional peaks that were not observed with the packed columns.

**Table 5—% Methanol Loss Measured with Headspace
Gas Chromatography (SP-1000 Carboxpack
Packed Column with Flame Ionization Detector)**

Time (min)	% Methanol Loss from Coating (Based on coating weight)		
	110°C	149°C	205°C
20	0.7	2.9	3.4
40	1.6	1.9	4.5
60	3.0	3.0	—

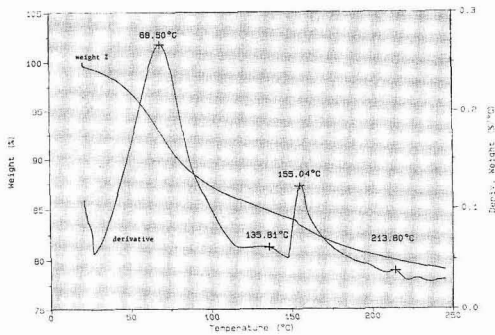


Figure 1—Wt % vs temperature for the TGA of the uncured coating

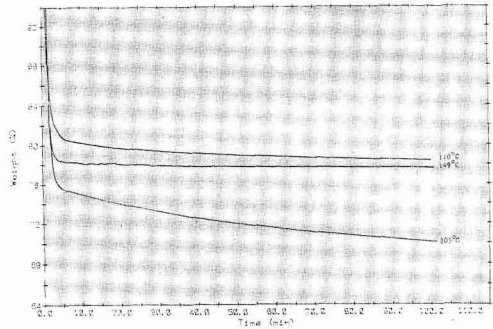


Figure 2—Isothermal wt % vs time curves for the uncured coating

The electron impact mode of ionization requires energy sufficient for ionization and fragmentation of analyte molecules (70 eV) by interaction with electrons from a hot filament. Some structural features of the analyte molecule can be deduced from the fragmentation pattern of the molecular ion. Recognition of the molecular ion depends on the type of compound and, in some cases, the molecular ion may represent only a small fraction of the total ion current.¹³

Chemical ionization differs from electron ionization in that molecules of the compound of interest are ionized by interaction or collision with ions of a reagent gas rather than with electrons.¹³

Chemical ionization provides mass-spectral information that often complements that from electron ionization. Chemical ionization achieves ionization of the analyte without transferring excessive energy to the ions and is considered a soft ionization technique. The result is the formation of abundant adduct ions (often protonated molecule) that contain the intact molecular species of the analyte. Because of the soft ionization process, the molecular adduct ions undergo little fragmentation as compared with electron ionization.¹³

The use of methanol reagent gas for CI application to esters was included in a recent study¹⁴ and produces primarily pseudo-molecular ions ($M+H^+$) and minimizes fragmentation. This technique allows assignment of the molecular ion when the EI spectra do not allow definitive assignment. The use of deuterated reagents for

chemical ionization (in this case deuterated methanol) allows identification of many nitrogen compounds. Primary, secondary, and tertiary amines give prominent ions depending on the number of exchangeable hydrogens present.

The dynamic purging experiments showed that each cure temperature tested yielded the same species (note that methanol was not collected under the conditions employed). The mass spectra from EI, methanol CI, and deuterated methanol CI detection did not result in the chemical identification of the components, but the results showed at least one peak (115 amu) that has a species with an odd number of nitrogens. Note that the other peaks may contain species with an even number of nitrogens. The presence of high nitrogen contents is suspected for the other peaks based on the odd (amu) fragment ions detected with EI. The rule for interpretation of nitrogen containing compounds is that a compound containing an odd number of nitrogen atoms will have an odd nominal molecular weight because of the fact that nitrogen has an even atomic weight and an odd valence. The compound will fragment to produce several ions of even m/z value if the nitrogen is retained in these fragment ions. An even number of nitrogen atoms will result in an even nominal molecular weight.¹³ The identity of suspected nitrogen containing species cannot be reported based on this work and may be of interest for further study. The EI data did not show significant molecular ions except for peak A (115 amu parent peak). CI mass spectral values were used

Table 6—Chemical Ionization Molecular Weights And Major Electron Impact Fragment Ions

Mass Spectral Peak Designation	Methanol CI Molecular Weight ^a	3 Major Fragment Ion Masses (amu) ^b	Relative Peak Heights (%) of Major Fragment Ions
A	115	72, 70, 100	100, 72, 52
B	132	43, 45, 72	100, 52, 50
C	132	59, 43, 29	100, 95, 28
D	104	31, 56, 73	100, 43, 30
E	146	32, 45, 28	100, 37, 36
F	214	129, 111, 55	100, 43, 38

(a) These molecular weights were determined with methanol CI as described in the text.
 (b) amu = atomic mass units.

to determine the molecular weight of each species. The molecular weights were determined to be as follows for peaks A to F (Table 6): A=115, B=132, C=132, D=104, E=146, and F=214. A summary of these results is shown in Table 6. As noted later, the m/z 132 and m/z 104 peaks are consistent with GC/FTIR spectral identifications of PM acetate and 2-hydroxymethyl-1,3, propanediol.

In addition, deuterated methanol CI experiments are expected to show the presence of easily exchanged (i.e., OH or NH) hydrogens on a molecule.¹⁵⁻¹⁷ This experiment indicated that none of the species detected had OH or NH groups, except for peak E which had one exchangeable hydrogen. Thus, there is no evidence that AMP-95 (2-amino 2-methyl 1-propanol), a component of the formulation, is responsible for the suspected presence of nitrogen. It would result in a molecular ion with m/z 85 which was not detected.

The hexamethoxymethyl melamine was subjected to the dynamic purging headspace analysis at 210°C, but none of the species that result from the curing of the coating were observed in the capillary column gas chromatogram. This observation, as well as the differences noted in the thermal decomposition curve, compared with the coating, indicates that none of the volatile compounds detected that result from curing the coating (to temperatures as high as 210°C) are attributable simply to decomposition of unreacted melamine.

Thermal Analysis

Thermogravimetric analysis of the uncured coating showed weight loss to occur through the temperature range of 30°C-260°C (Figure 1). The weight % vs temperature curve indicates three temperature ranges that exhibit an increase in the rate of loss. These inflection points that occur at 38°C, 68°C, and 155°C suggest that either the kinetics change during the course of the cure reaction, additional volatile products are released, or a constituent has been depleted.

Isothermal weight percent vs time curves obtained at 110, 149 and 205°C (Figure 2) demonstrate that weight loss occurs to a different extent at each of the temperatures tested. Each curve shows significant weight loss initially (within the first five minutes) and then a leveling off through 100 min.

The calculated amount of methanol loss based on the conversion of all the methoxy groups that can react with the hydroxyl groups present in the polyester is 3.3%. This value subtracted from the nonvolatile content based on solvent loss (81.44%) results in a calculated nonvolatile content of 78%. This is in agreement with the isothermal wt% obtained at 149°C.

The calculated methanol loss from the conversion of all the methoxy groups available from the hexamethoxymethyl melamine (4.5%) results in a calculated nonvolatile content of 77%. The comparative time profile of the coating heated isothermally at 205°C shows a greater weight loss than that attributable to the loss of methanol from hexamethoxymethyl melamine.

The polyester-hexamethoxymethyl melamine system catalyzed with an alkyl benzene sulfonic acid that was

used in this study contains a more fully methylated type of melamine. This type of melamine does not tend to self-condense at moderate temperatures as reported by Hill³ and Blank.⁴ However, at higher temperatures, such as at 205°C, the more fully alkylated melamine will self-condense, as reported by Hill.³ Some of the reaction products that are predicted for self-condensation reactions with a butylated hexamethoxymethyl melamine include water, formaldehyde, and butanol. The self-condensation reaction probably accounts for the continued weight loss that is observed with thermal analysis when the coating is heated isothermally at 205°C.

The weight loss profile of the hexamethoxymethyl melamine is quite different compared with the formulated coating. There is less weight loss observed at 110, 130 and 149°C, but the weight loss approaches an asymptotic decomposition above 200°C.

The volatile products of the coating that were evolved from the TGA module were trapped to collect the components released between 100°C-250°C. Infrared spectra were obtained with GC/FTIR analysis of the trapped components which were tentatively identified with a computer library search. The compounds that were tentatively identified include PM acetate and methanol and 2-hydroxymethyl-2-methyl-1,3 propanediol. Other peaks that were evaluated but which could not be specifically identified may include classes of compounds such as a dicarboxylic acid and its dimethyl-ester and complex decomposition products. Three of the peaks evaluated appear to contain formaldehyde and may result from labile decomposition products.

Some of the compounds that were detected with GC/FTIR in the trapped volatile components from the coating are consistent with the molecular ions detected with GC/

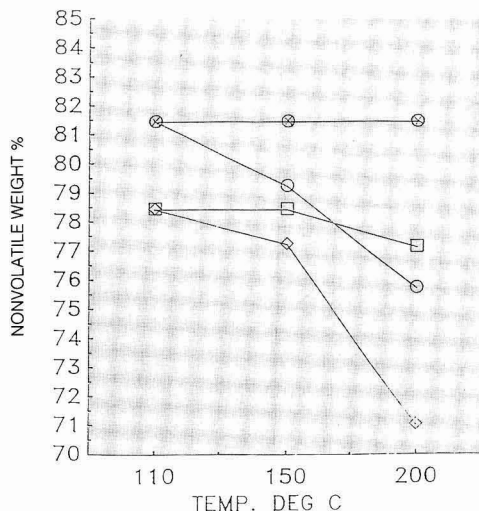


Figure 3—Nonvolatile wt% vs temperature for 20 min bake time. ○—○, ASTM; □—□, theor.-meoh (based on headspace GC data); ◇—◇, TGA; and ⊗—⊗, theor.

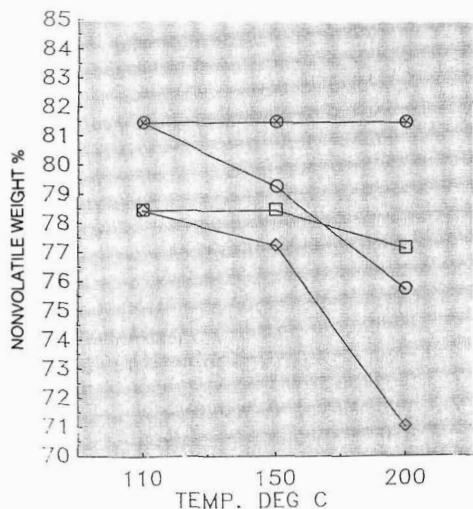


Figure 4—Nonvolatile wt % vs temperature for 40 min bake time. ○—○, ASTM; □—□, theor.-meth (based on headspace GC data); ◇—◇, TGA; and ⊗—⊗, theor.

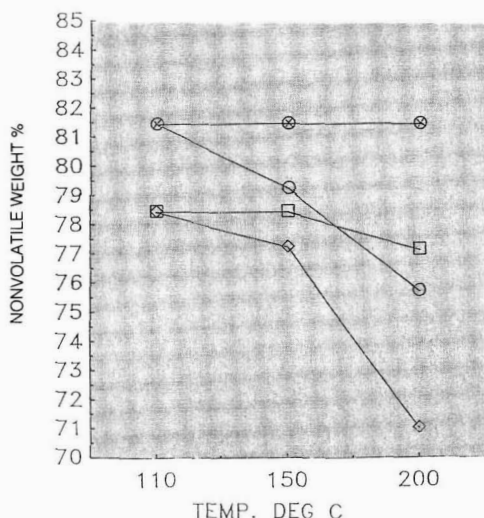


Figure 5—Nonvolatile wt % vs temperature for 60 min bake time. ○—○, ASTM; □—□, theor.-meth (based on headspace GC data); ◇—◇, TGA; and ⊗—⊗, theor.

mass spectrometry techniques. These include PM acetate (m/z 132) and 2-hydroxymethyl-2-methyl-1,3 propane-diol (m/z 104). Note that methanol was not collected under the conditions used in the GC/mass spectrometry study.

The results indicate that methanol and the solvent, PM acetate, are the major volatile compounds released during the cure of this particular coating formulation. However, other components that are likely decomposition products from the polyester also are present. A depiction of the weight loss profiles that compare solvent and methanol loss, and thermogravimetric measurements with the ASTM D 2369-81 determination, modified for different time and temperature conditions, are shown in Figures 3-5.

The wt% vs temperature plots that compare the measurement techniques discussed are instructive. The theoretical nonvolatile content based on solvent loss of course remains constant. The ASTM procedure, applied as shown for 20 min time, is compared at different temperatures with the nonvolatile matter that is calculated if methanol loss is subtracted from the theoretical nonvolatile matter. Also included are the nonvolatile contents obtained with thermogravimetric analysis.

The data for 20 min residence time (Figure 3) are scattered but begin to show a trend. The measurements that include nonvolatiles based on methanol loss, ASTM procedure nonvolatiles, and thermogravimetric nonvolatiles deviate from the theoretical value as the temperature is increased. The TGA results show more extreme deviation.

When similar plots are examined for 40 min residence time (Figure 4) the trends become more apparent. The nonvolatile matter calculated based on the methanol loss data show fair agreement with the modified ASTM proce-

dure. Again, the TGA results show more dramatic changes.

The more extreme weight loss observed with TGA is attributable to the small sample size used experimentally. The sample weight is in the range of 10-20 mg, rather than a few tenths of a gram as employed with the ASTM procedure and methanol loss measurements. Therefore, the sample has excellent physical contact with the heat source and the sample temperature changes almost instantaneously with the surroundings. Thus, the volatile materials are efficiently removed from the sample and are swept from the surrounding environment by a continuous flow of carrier gas.

In the final comparison shown for 60 min residence time (Figure 5), the ASTM nonvolatiles show fair agreement with calculations that include methanol loss data at 150°C and 205°C. The TGA results continue to show greater weight loss.

The plots suggest that methanol loss accounts for the major discrepancy of the theoretical VOC values and modified ASTM procedure determinations as the temperature is increased. However, it must be noted, as indicated in this study, that other factors such as kinetic changes, possible loss of nitrogen containing products, and decomposition products also influence the weight loss data.

Physical Properties of Cured Coatings

Physical properties of the coating film (1 ± 0.1 mils) cured for 20 and 60 min at 110°C, and 20 min at 135, 149, and 205°C, are shown in Table 7. A progressive increase was observed in pencil hardness to 149°C and variations were observed in direct and reverse impact measurements. The impact measurements showed a de-

Table 7—Physical Properties of the Polyester-Melamine Coating Cured at Different Conditions (Time, Temperature)

Cure Schedule		Pencil Hardness	D/R Impact	MEK Rubs	T _g (°C)
Time (min)	Temp (°C)				
20	110	3B	80/90	30	2.0
60	110	F	160/140	200	26.3
20	135	H	150/140	500	—
20	149	3H	160/120	500	46.6
60	149	—	—	—	49.4
20	205	3H	40/5	500	44.4
60	205	—	—	—	37.8

crease in properties when the coating was cured at 205°C. The MEK rubs increased from 30 (cured 20 min at 110°C) to 500 rubs when cured at 135°C or higher temperatures (20 min).

The T_g of the coatings cured under these conditions were measured with TMA and show the highest value (49.4°C) at the temperature recommended (149°C) to cure this coating. The data show that almost no cure is achieved for 20 min at 110°C since the T_g is only 2.0°C and considerable undercure is achieved for 60 min at 110°C (T_g 26.3°C). A lower T_g was observed when the coating was cured at 205°C and may indicate that decomposition had occurred.

SUMMARY

This work and other literature reports indicate a need to adopt a more reliable procedure to be used by coating suppliers and users to determine volatile organic content (VOC) in high-solids coatings that contain melamine crosslinkers. Volatile contents should be determined with the time and temperature conditions that most closely approximate the conditions used on the production line.

The measurements of VOC with the EPA recommended procedure, modified with variation in the time and temperature of heating, show changes that reflect higher VOC with increased time and temperature. These observations are consistent with the volatilization of methanol measured in this study and other species that were tentatively identified as well as some species that were detected and not identified.

The measurements of increased volatiles that are evolved from the coating also are consistent with thermogravimetric GC/mass spectral data and GC/FTIR measurements that indicate changes in reaction products occur as the cure temperature is increased. Changes were also noted in the physical properties of the film cured at increased temperatures.

The polyester-hexamethoxymethyl melamine system catalyzed with an alkyl benzene sulfonic acid that was used in this study contains a more fully methylated type of melamine that does not tend to self-condense at moderate temperatures (below 150°C). More complex cross-linking reactions are expected to occur with melamine type crosslinkers that are not fully substituted and that contain alkoxy, hydroxyl, and amine functionality. This emphasizes the need to agree on a VOC procedure that is more representative of the volatiles actually released at cure temperatures above 110°C.

ACKNOWLEDGMENT

The members of the Northwestern Society Technical Committee thank Dr. Steven B. Hawthorne and David J. Miller of the University of North Dakota for the gas chromatography/mass spectrometry work and Mr. Kenneth Kempfert of the Nicolet Applications Laboratory in Madison, WI, for the TGA/FTIR work conducted in support of this investigation.

References

- (1) Federal Register, Vol. 45, No. 194, CFR Part 60 PP65956.
- (2) Lindlaw, W., Peterkofsky, A.L., and Vona, J.A., "New Developments in Formaldehyde Coating Resins," *JOURNAL OF PAINT TECHNOLOGY*, 41, No. 538, 641 (1969).
- (3) Hill, L.W. and Kozlowski, K., *Proc. 14th Water-Borne and Higher-Solids Coatings Symposium*, Feb. 24-27, 1987, New Orleans, LA.
- (4) Blank, W.J., "Reaction Mechanism of Melamine Resins," *JOURNAL OF COATINGS TECHNOLOGY*, 51, No. 656, 61 (1979).
- (5) Bauer, D.R., *Progr. Org. Coat.*, 14, 193 (1986).
- (6) Santer, J.O., *Progr. Org. Coat.*, 12, 309 (1984).
- (7) Bauer, D.R. and Budde, G.F., *J. Appl. Polymer Sci.*, 28, 253 (1983).
- (8) Berge, A., Kraeven, B., and Ugelstad, J., *European Polymer J.*, 6, 981 (1970).
- (9) Koral, J.N. and Petropoulos, J.C., "Hexakis (Methoxymethyl)-Melamine: Its Chemistry and Utilization in Surface Coatings," *JOURNAL OF PAINT TECHNOLOGY*, 38, No. 501, 600 (1966).
- (10) van Zuylen, J., *J. Oil & Colour Chemists' Assoc.*, 52, 861 (1969).
- (11) Secrest, P.J. and Heckman, S.E., "Determination of Nonvolatile Contents of Amino Polymers," *JOURNAL OF PAINT TECHNOLOGY*, 43, No. 562, 81 (1971).
- (12) Sharp, P.F. and Wright, G., *J. Oil & Colour Chemists' Assoc.*, 58, 210 (1975).
- (13) Watson, J.T., "Introduction to Mass Spectrometry," Raven Press (1985).
- (14) Hawthorne, S.B. and Miller, D.J., *Appl. Spectr.*, 40, No. 8, 1200 (1986).
- (15) Hawthorne, S.B. and Miller, D.J., Submitted to *Fuel*, March 1987.
- (16) Buchanan, M.V., *Anal. Chem.*, 56, 546 (1984).
- (17) Buchanan, M.V., *Anal. Chem.*, 54, 570 (1982).



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A High Solids One-Component, Low Temperature Bake Epoxy Coating

Marcia Agostinho and Vincent Brytus
CIBA-GEIGY Corp.*

A current challenge to suppliers and formulators is reducing the volatile organic compound (VOC) in coatings while maintaining low viscosity and good cure properties.

One approach to lowering the VOC has been to reduce the molecular weight of the polymer, which in turn reduces the viscosity of the system. This can result in a loss in physical properties of the coating.

A different approach involves the use of a solid latent hardener in combination with liquid epoxy resins, which cures through epoxy functionality. This has developed into a high solids epoxy coating possessing improved properties over existing primer systems and is the subject of this paper.

INTRODUCTION

Heat cured solvent based epoxy coatings have been available for many years. They have been used as interior coatings for food and beverage containers, primers on coil coated metal, automotive primers, drum and pail liners, spray and dip applied primers on finished products, etc. They are used because of their excellent adhesion and chemical and atmospheric corrosion resistance.

In most of these applications, the mechanism of cross-linking is not through the epoxy groups but through the secondary hydroxyls along the chain of the higher molecular weight epoxies (Figure 1). The crosslinkers are aminoplasts such as melamines and urea formaldehyde resins or phenoplasts such as phenolic resins¹ (Figure 2). These are condensation reactions taking place at temperatures ranging from 300° to 550°F. Cure times range from under 30 sec peak metal temperature to over 30 min. At

room temperature, they exhibit good one-component stability. Because higher molecular weight resins (epoxy equivalent weights of 1000-5000) are used to provide sufficient hydroxyl functionality, these systems tend to be in the 30-50% solids range. In some applications, it is desirable to reduce the solvent content or reduce the curing requirements.

Some new types of resins have come on the market which reduce the solvent demand of the epoxy, thus lowering the volatile organic compound (VOC).² Lower cure schedules have been achieved by modifying the alpha glycol content of the epoxy. Faster aminoplasts are also available. A different approach utilizes a latent amine curing agent in combination with epoxies.³ This has lower bake temperatures as well as lower VOC. The latent curing agent is the subject of this paper.

BLOCKED AMINE CHEMISTRY

Amine curing agents are widely used with epoxy resins; they cure by addition through the epoxy groups (Figure 3). This curing is a very fast reaction approaching completion within hours after mixing the epoxy and amine at room temperature. These amine curing agents make up the bulk of the two-component epoxy systems. However, it is possible to block the amine in such a way that reactivity is reduced and it is stable for months even

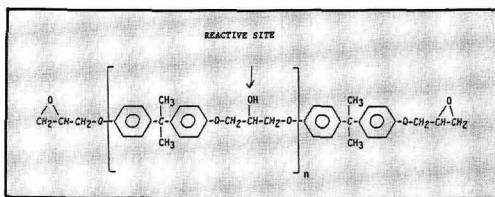


Figure 1—Bisphenol A diglycidyl ether (DGEBA)

*Presented at the 15th Water-Borne and Higher Solids Coatings Symposium, in New Orleans, LA, on February 4, 1988.

*444 Saw Mill River Rd., Ardsley, NY 10502.

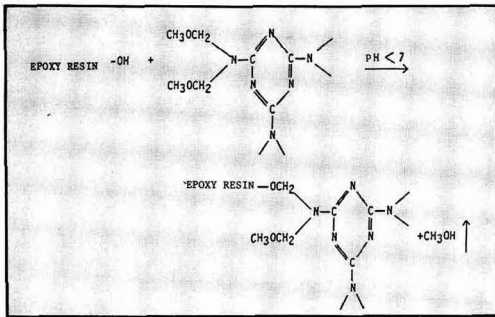


Figure 2—Crosslinking with aminoplasts hydroxyl with methoxymethyl functionality

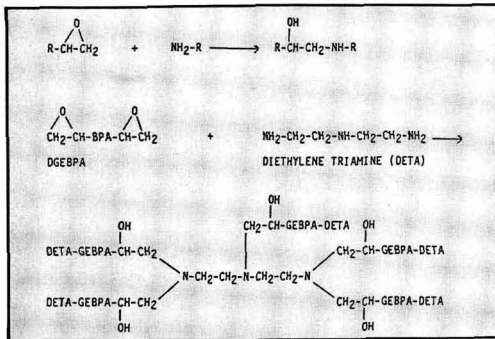


Figure 3—Amine curing agents

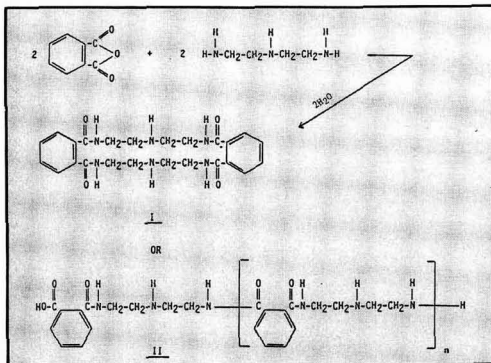


Figure 4—Forms of the reaction product of phthalic anhydride and diethylene triamine (DETA)

when blended with the epoxy. When the temperature necessary to unblock it is reached, the amine is then liberated to cure rapidly.

A specific example is the reaction product of phthalic anhydride with diethylene triamine to form a monoamide and then a diamide. The theoretical chemistry is represented in Figure 4, Form I. The result is an amorphous yellow solid melting in the range of 96°-113°C. It is uncertain whether the product is predominantly the cyclic tetra-amide (Figure 4, Form I) or the linear polyamide (Figure 4, Form II). In either case, the primary amine has been converted to an amide. The amide hydrogen has very low reactivity with the epoxy. Remaining are secondary amine hydrogens which are reactive with the epoxy. The solid amide is, however, incompatible with the epoxy. It is physically separated from the resin in the form of a dispersion when blended with it. This preserves latency.

At a temperature of approximately 80°C, the phthalamide converts to a phthalamide liberating soluble diethylene triamine. The theoretical reaction is represented in Figure 5. The diethylene triamine then rapidly reacts with the epoxy resulting in cure.

In actual practice, the phthalamide is ground to a powder and dispersed in a liquid epoxy resin that has an epoxy equivalent weight of 190 and a viscosity of approximately 14,000 cP. The recommended mix level is 35 parts by weight phthalamide to 100 parts of epoxy. The ratio was arrived at by optimizing on the highest heat deflection temperature, 97°C, obtained after curing for three hours at 150°C (300°F) (Table 1). In the uncured state, the mixture is an opaque liquid with a viscosity of 110,000-130,000 cP at 25°C.

Gel time, as determined by the gel pickup method, is typically 45-55 sec at 150°C. This can vary with the mixing ratio and also with temperature, as seen in Table 2.

The effects of temperature, particle size, and distribution, as well as the addition of modifiers and solvents, and moisture absorption were studied. Investigated were the one-component stability at room temperature and at elevated temperatures, the effect of particle size distribution on viscosity and stability, the effect of incorporating other epoxy modifiers and solvents on stability, and the effects of moisture absorption.

ONE-COMPONENT STABILITY

The stability of the phthalamide in the epoxy was measured by following the viscosity increase of the mix at a given temperature and the change in the reactivity. Stability studies were conducted on the mix after storing at 25, 40, and 55°C. The results are reported in Table 3. The gel times do not appear to change under these storage conditions. The viscosity at 25°C remains unchanged even after six months. At 40°C, there is a 17% increase between two and four weeks and, at 55°C, there is a substantial increase over time.

The stability of this hardener, as expressed by viscosity change and gel time, at room temperature (25°C), is very good. In warmer conditions, some loss of stability can be expected.

Table 1—Mixing Ratio vs HDT

Parts of Hardener per 100 Parts of Liquid Epoxy Resin	HDT, °C After 3 hr @ 150°C
25	78
30	90
35	97
40	95
45	90

Table 2—Gel Time for Various Mixing Ratios and Temperature

Parts per 100 Parts of Liquid Epoxy Resin	Temperature, °C	Gel Time, sec
25	150	76
30	150	58
35	100	300
35	121	124
35	150	54
40	150	45
45	150	41

Table 3—One-Component Stability of Phthalamide Dispersed in Epoxy Resin^a

Temperature	Initial	1 Week	2 Weeks	4 Weeks	3 Mos	6 Mos
25°C viscosity, cP	120,000	125,000	120,000	115,000	110,000	110,000
Gel time @ 150°C, sec	47	47	47	46	48	45
40°C viscosity, cP	113,000	112,000	113,000	132,000	—	—
Gel time @ 150°C, sec	—	—	—	—	—	—
55°C viscosity, cP	121,000	169,000	210,000	547,000	—	—
Gel time @ 150°C, sec	47	55	50	49	—	—

(a) wpeq 190.

Table 4—Stability of Modified Resins
Viscosity, cP at 25°C After Storage at Temperature

	Temp. (°C)	Initial	1 Week	2 Weeks	4 Weeks	Extended
Butylglycidyl Ether	25	9,700	—	—	9,400	17,900-4 mos
	40	9,700	9,900	10,700	10,400	34,300-3 mos
	55	9,700	gel	—	—	—
Cresylglycidyl Ether	25	9,800	—	—	9,700	12,300-4 mos
	40	—	—	—	—	—
	55	9,800	gel	—	—	—
Butanediol Diglycidylether	25	7,900	—	—	8,400	—
	40	7,900	8,400	8,500	8,200	20,400-3 mos
	55	7,900	gel	—	—	—
C ₈ -C ¹⁰ Glycidylether	25	—	—	—	—	—
	40	—	—	—	—	—
	55	9,000	20,000	52,000	395,000	—
P-tert-butyl Phenylglycidyl Ether	—	—	—	—	—	—
	55	93,000	130,000	156,000	349,000	—
Dibutyl Phthalate	—	—	—	—	—	—
	55	46,000	55,000	58,000	75,000	107,000-6 wks
Benzyl Alcohol	25	12,100	1,633,000	—	gel	—
	40	12,100	gel	—	—	—
Methylethyl Ketone	25	1,312	—	—	1,385	10,000-4 mos
	40	1,312	12,450	146,000	gel	—
	55	1,312	gel	—	—	—

Table 5—Resin Stability at Different Moisture Content Levels

% Water	Viscosity, cP at 25°C After Storage at 55°C			
	Initial	1 Week	2 Weeks	4 Weeks
0.6	121,000	169,000	210,000	547,000
1.0	111,000	270,000	750,000	gel
1.4	110,000	1,400,000	gel	—
1.7	112,000	3MM	gel	—
2.1	109,000	gel	—	—

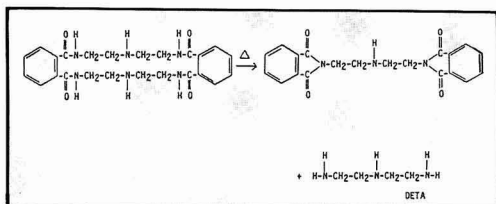


Figure 5—Liberation of diethylene triamine

Table 6—Epoxy Modified Vinyl Plastisol

Vinyl Resin Dispersion	Parts by Weight
Vinyl resin	100.0
Dioctyl phthalate	45.0
Polymeric plasticizer	3.0
Stabilizer	2.5
Thixotropic agent	1.0
Pigment Dispersion	
Titanium dioxide	8.1
Dioctyl phthalate	5.4
Epoxy Modifier	
Liquid DGEBA	15.0
Phthalamide	25.5

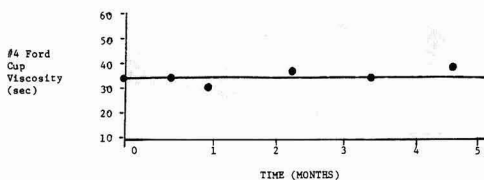


Figure 6—Primer formulation stability at 25°C

Table 7—Epoxy Modified Vinyl Plastisol Cured Properties

	Initial	After 12 mos Aging @ 25°C, 50% RH
Mixed viscosity @ 25°C, cP	26,750	27,550
Film Properties (cure: 15 min @ 180°C)		
Film thickness, mills	10	10
Peel strength, lb-in.	4.2	4.5
Flexibility, 1/8" mandrel bend	Pass	Pass
Gloss, 60°C	20	13
Chemical Resistance		
1 hr boiling water	Unaffected	Unaffected
Gasoline, 24 hr	Unaffected	Unaffected
Xylene, 24 hr	Unaffected	Unaffected

PARTICLE SIZE

As mentioned, the phthalamide has secondary amine hydrogens available for reacting with the epoxy groups. At low temperatures, the phthalamide is physically separated from the epoxy by phase. Thus, secondary amine hydrogens are unavailable for reaction with the epoxy. However, some amino hydrogens are on the surface of the particles and react. Each particle in effect forms a thin gel coat on the surface. Therefore, the particle size or, more correctly, the surface area has an effect on the viscosity of the mix. The smaller the particle size, the greater the surface area or amount of gel coating. At very fine grinds the mix can become a soft gel which is no longer processable.

Not as obvious an influence on stability is maintaining the particle size during further processing. When dispersing the phthalamide into the resin, care must be taken not to grind the particles any further. Pigments should be dispersed into a mill base with the epoxy, and the phthalamide should be added later. The temperature of the system during the hardener dispersion should also be kept below the unblocking temperature to prevent reaction. Hobart mixers and ball mills have been found to be successful. High speed dispersers may be used if carefully monitored.

MODIFIER AND SOLVENT EFFECTS ON STABILITY

At room temperature, the viscosity of the mix exceeds 100,000 cP. For spray applications, formulations will have to be greatly reduced by using solvent or a combination of solvents and lower viscosity epoxy diluents. For the same reason that a larger particle surface area increases the number of secondary amino hydrogens available for reaction, anything that compatibilizes the phthalamide with the epoxy also can destroy latency. Any solvent which dissolves the phthalamide in the epoxy will make all of the secondary amino hydrogens available and the mixture will gel in less than a week.

Generally, the phthalamide is soluble in highly polar solvents and insoluble in nonpolar solvents. For example, it is very soluble in water and methanol and partially soluble in MEK. It is insoluble in xylene.

One method of reducing viscosity without using solvents is through the use of low viscosity, reactive and nonreactive diluents. Typical nonreactive diluents are benzyl alcohol, nonylphenol, or dibutyl phthalate. Nonylphenol also acts as an accelerator. Reactive diluents are low molecular weight epoxy functional compounds such as butyl glycidyl ether, cresyl glycidyl ether, p-tert-butyl glycidyl ether, glycidyl ethers of C-8 through C-14 alcohols, and butane diol diglycidyl ether. Stability studies have been conducted on a number of these at 25°, 40°, and 55°C (see Table 4).

The p-tert-butyl phenyl glycidyl ether and dibutyl phthalate did not adversely affect latency compared to the control. Butyl and cresyl glycidyl ethers destroyed latency at 55°C but not at 40°C. The glycidyl ethers of C-8 and C-10 alcohols had less of an effect at 55°C and therefore

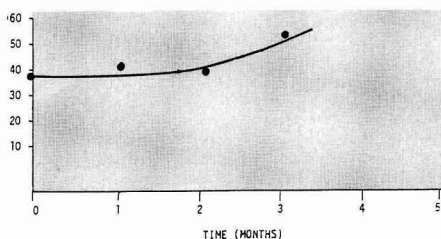


Figure 7—Primer formulation stability at 50°C

Table 8—High Solids Primer Application

Primer Formulation	Parts by Weight	
Liquid DGEBPA	45.5	
Liquid DGEBPF	11.5	
C ₁₂ -C ₁₄ monoglycidylether	19.5	
Phthalamide	23.5	
Barium sulfate	81.0	
Red iron oxide	5.5	
Titanium dioxide	7.5	
Silica	4.5	
Zinc chromate	1.5	
	200.0	
Comparison of Solvent Content and VOC^a		
Weight, % solids	85	90
Viscosity, sec, #4 FC, 25°C	18	33
Volume, % solids	74	82
VOC, lb/gal	1.9	1.3

(a) The formulation was reduced to application solids with xylene using the above data as a guide.

should be stable at 40°C. Benzyl alcohol promoted a substantial viscosity increase even at 25°C.

A quick method for testing a solvent or diluent is to add it to the phthalamide powder. If the powder picks up any color or seems to swell or soften, the latency is likely to be substantially reduced or destroyed.

EFFECTS OF MOISTURE ON LATENCY

The phthalamide is extremely hygroscopic. In powder form, it can pick up several percent moisture and become wet and sticky in two hours if exposed to a humid environment. The moisture content is a major influence on latency of the dispersion. As mentioned previously, moisture enhances the compatibility of the phthalamide with the epoxy. When the phthalamide contains 7.5% water, the dispersion becomes translucent. At 15% water, the dispersion becomes clear and the viscosity increases rapidly at room temperature (see Table 5). It is important to keep the phthalamide protected from moisture or high humidity, especially in powder form. When dispersed in the epoxy, the phthalamide is less likely to pick up water because the epoxy is hydrophobic. The dispersion should be kept away from high humidity.

Table 9—Primer Cured Properties

Substrate	Cold rolled steel	
Cure cycle	30 min @ 275°F	
Dry film thickness, mils	1.0	
Mechanical Properties		
Pencil hardness	6H	
Adhesion	Excellent	
Impact resistance, in.-lbs		
Direct	160	
Reverse	160	
1/8" mandrel bend	Pass	
MEK double rubs	250	

Corrosion Resistance (1000 hr) (ASTM B-117)	Formulation	Clear
Blisters	None	None
Creep, in.	1/8	1/8

Humidity Resistance (2000 hr) (Cleveland Condensing Humidity Cabinet)	Formulation	Clear
Formulation		No effect
Binder w/o pigment		No effect

Chemical Resistance (18 mon)	Substrates Sandblasted steel	Cold Rolled steel
------------------------------	---------------------------------	----------------------

Reagents		
Leaded gasoline	+ ^a	+
Unleaded gasoline	+	+
Gasohol (10% ethanol)	+	+
MEK	+	+
Xylene	+	+
Butyl acetate	+	+
Ethanol, 50%	F @ 10 wks	10 wks
Distilled H ₂ O	+	+
HCl, 10%	F @ 1 wk	1 wk
H ₂ SO ₄ , 10%	F @ 1 wk	1 wk
NH ₄ OH, 10%	+	6 wks
N ₂ OH, 10%	+	1 wk

(a) + = unaffected.

APPLICATIONS IN COATINGS

The epoxy phthalamide system was evaluated in coatings. The first application studied was as a system modifier for a vinyl plastisol. Epoxies are added to vinyl plastisol formulations to improve adhesion and gasoline resistance. The formulation given is in Table 6.

The vinyl resin was added to the plasticizer until completely wet out. Stabilizers, polymeric plasticizer, and thixotrope were then added and mixed for 10 min. The mixture was passed once through a three roll mill. In a separate step, titanium dioxide was added to the plasticizer and passed twice through a three roll mill. The vinyl dispersion, pigment dispersion, and phthalamide dispersion in epoxy where then blended. The final mixture was passed twice through a three roll mill and was then ready to test.

Table 7 contains the initial properties and those after 12 months at 25°C. Excellent solution stability was found after one year with no significant increase in viscosity and no decrease in reactivity.

The second application was a high solids primer. To obtain the lowest VOC at a sprayable viscosity, and to achieve maximum cured properties, a blend of bisphenol A and bisphenol F resins with an aliphatic glycidyl ether was used (see Table 8). Xylene was added to reduce the

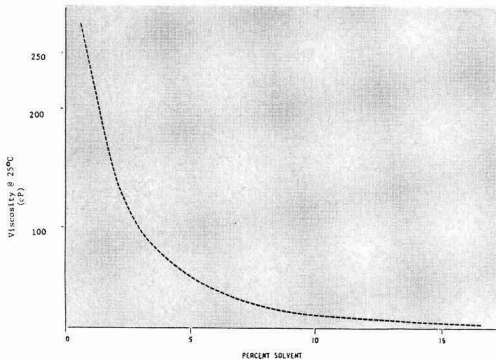


Figure 8—Primer formulation viscosity vs solvent level

viscosity to 18-22 sec in a #4 Ford cup at 25°C. The resulting VOC was 1.9 lb/gal. Xylene was chosen because it does not affect latency.

Coatings were applied and cured for 3 min at 275°F. The properties, shown in Table 9, were excellent. Stability studies were conducted on the total formulation and

were found to be very good, even at 50°C (see Figures 6 and 7).

CONCLUSION

Because the phthalamide can be used with low viscosity resins and can be an insoluble solid dispersion, viscosity of formulations containing the phthalamide mixed can be greatly reduced with the inclusion of only small amounts of solvent. This provides very high solids (see Figure 8). When unblocked, the phthalamide liberates a very fast curing amine which can cure epoxy at relatively low temperatures. This allows faster, lower temperature cure. It also results in the expected epoxy characteristics of excellent adhesion and corrosion resistance. The phthalamide offers another approach to oven cured epoxy coatings.

References

- (1) For example, Cymel 370, a product of American Cyanamid Co., Wayne, NJ.
- (2) Payne, K.L. and Puglisi, J.S., "New Epoxy Resin for High Solids and High Performance," *JOURNAL OF COATINGS TECHNOLOGY*, 59, No. 752, 117 (1987).
- (3) Puglisi, J. and Sammel, R., "One-Component Epoxy," *Mod. Paint Coat.*, October, 1985.

Society Meetings

CHICAGO MAY

Awards Banquet

The new slate of officers for 1988-89 is: President—Evans Angelos, of Omya, Inc.; Vice President—Keven P. Murray, of De-Soto, Inc.; Secretary—Karl E. Schmidt, of Premier Paint Co.; Treasurer—Theodore J. Fuhs, of General Paint & Chemical Co.; and Society Representative—Richard M. Hille, of General Paint & Chemical Co.

In addition, William W. Fotis, of The Enterprise Cos., was elected Membership Committee Chairman.

President Angelos was presented with the Nuodex Gavel by Patrick Gorman, of Nuodex, Inc. Past-President Raymond J. Cziczo, of Reliance Universal, Inc., was awarded a Certificate of Appreciation for his years of service.

Albert E. Counter, Retired, and Milton Glaser, Federation and Society Honorary Member, received their 50-Year Pins from Victor M. Willis, of Ace Paint Div., Ace Hardware.

CLIFFORD O. SCHWAHN

CLEVELAND APR.

"Plasma Technology"

The following members were nominated for officer positions for 1988-89: President—R. Edward Bish, of Jamestown Paint & Varnish Co.; Vice President—Iлона Nemes-Nemeth, of Sherwin-Williams Co.; Secretary—Richard J. Ruch, of Kent State University; Treasurer—Ben J. Carlozzo, of Tremco Corp.; Assistant Treasurer—Roy A. Glover, of Jamestown Paint & Varnish Co.; and Member-at-Large—Sharon L. Kaffen, of Glidden Co.

The evening's speaker was Peter Rose, of Plasma Science Inc. Dr. Rose spoke on "PLASMA SURFACE TREATMENT FOR ENHANCED ADHESION OF COATINGS FOR PLASTICS."

The speaker discussed the importance of plasma technology to the coatings industry and the benefits it provides. Several areas of importance include: improvement in the interfacial adhesion of materials that have been plasma treated; alteration of surface wetting properties including thermoplastics, fluoropolymers, rubbers, and modification of diffusion properties; and versatility, cleanliness, safety, and the fact that no disposal is needed.

The speaker described the four effects accomplished by plasma treatment. The major effect is cleaning, followed by ablation, crosslinking, and most important, surface modification.

In conclusion, Dr. Rose said plasma technology is used commercially in the coatings, medical, and electronic industries.

ILONA NEMES-NEMETH, *Secretary*

CLEVELAND MAY

"Methods of Criminal Investigation"

Elected to office for 1988-89 were: President—R. Edward Bish, of Jamestown Paint & Varnish Co.; Vice President—Iлона Nemes Nemeth, of Sherwin-Williams Co.; Secretary—Richard J. Ruch, of Kent State University; Treasurer—Ben J. Carlozzo, of Tremco Corp.; Assistant Treasurer—Roy A. Glover, of Jamestown Paint & Varnish Co.; and Member-at-Large—Sharon L. Kaffen, of Glidden Co.

Also, Fred G. Schwab, of Coatings Research Group, Inc., will continue to serve as Society Representative.

Sam Huey, Retired, and George Selden, Retired, were elected Society Honorary Members.

Society Honorary Member Michael Malaga received the Selden Award which recognizes important contributions to the science of paint chemistry. Mr. Malaga was presented with a plaque for his accomplishments in the area of paint chemistry.

Jeffrey Lynn, a Bureau Criminal Investigator for the state of Ohio, presented a talk on "SCIENTIFIC METHODS OF CRIMINAL INVESTIGATION."

Mr. Lynn spoke about the nature of the bureau which attempts to prove or disprove alibis, connect or eliminate suspects, provide leads in cases, and identify contraband (50% of which are drugs).

The speaker also described how gas chromatography with capillary columns is used in paint analysis. Mr. Lynn said that frequently paint chips can be easily identified by the layer structure of the undercoat and successive top coats.

RICHARD J. RUCH
Acting Secretary

GOLDEN GATE MAY

"Under Utilized Kaolin"

Jack Duis, of Pacific Coast Chemical Co., was elected Secretary of the Advisory Committee.

Tom Kam, of the Redwood City Public Library, Redwood City, CA, gave a brief talk on the Society's growing paints and coatings technology collection. By the end of this year, Mr. Kam expects to have the 700-volume Rohm and Haas Company collection, which was acquired two years ago, catalogued by subject.

The meeting's technical speaker was Southern Society member Dan Dixon, of Engelhard Minerals & Chemicals Corp. Mr. Dixon's topic was "UNDER UTILIZED KAOLIN."

According to the speaker, calcined and specialty hydrous kaolin grades have received most of the attention from the coatings industry. He attributed this to their excellent color, opacity, particle size, and other qualities, particularly in light of the current titanium situation. Mr. Dixon spoke of a grade of kaolin that is very much under utilized by the coatings industry. He described many formulas depicting various



PAST-PRESIDENTS—Attending the Chicago Society May Awards Banquet are (l-r): Carroll M. Scholle (1958); Warren C. Ashley (1955); Edward W. Boulger (1968); James Patterson, Jr. (1962); Raymond R. Pfohl (1969); and Robert W. Zimmerman (1974)

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). ILONA NEMES-NEMETH, Sherwin-Williams Co., Cleveland Technical Center, 601 Canal Rd., Cleveland, OH 44113.

DALLAS (Thursday following second Wednesday—The Harvey Hotel, Dallas, TX). RHONDA MILES, Union Carbide Corp., 2326 Lonacker 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). GORDON PIOCH, Triangle Coatings, Inc., 1930 Fairway Dr., San Leandro, CA 94577.

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). NICK DISPENZA, Davis Paint Co., P.O. Box 7589, N. Kansas City, MO 64116.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA.) JAMES F. CALKIN, E.T. Horn Co., 16141 Herron Ave., La Mirada, CA 90638.

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 0R9 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. HUNN, Loos & Dilworth, Inc., 61 E. Green Ln., Bristol, PA 19007.

PIEDMONT (Third Wednesday—Americana Inn, Greensboro, NC). FOREST G. FLEMING, Reliance Universal, Inc., P.O. Box 2124, High Point, NC 27261.

PITTSBURGH (Second Monday—Montemurro's, Sharpsburg, PA). JAMES LORE, Watson Standard Co., P.O. Box 11250, Pittsburgh, PA 15238.

ROCKY MOUNTAIN (Monday following first Wednesday—Holiday Inn North, Denver, CO). PAUL D. SILVA, Kwal Paints, Inc., 3900 Joliet St., P.O. Box 39485, Denver, CO 80239.

ST. LOUIS (Third Tuesday—Salad Bowl, St. Louis, MO). HOWARD JEROME, Moxel Equipment Co., 4003 Park Ave., St. Louis, MO 63110.

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.

mixes of kaolin and calcined clays. These formulas demonstrated the attributes and limitations of their physical performance contributions to coatings.

Q. Delaminated kaolins have been used in the paper industry in a binder starved system to gloss up the paper. Is there any evidence of leafing of the clay platelets, which could be made use of in the paint industry?

A. The paper industry seems to feel the paint industry knows more about the effects of extender pigments in coatings than they do. That's a very good question that should be looked into.

GORDON N. PIOCH, *Secretary*

HOUSTON MAY

"Isoparaffins"

Installed as officers for 1988-89 were: President—James Ignatow, of International Paint (USA), Inc.; Vice President—Sandra S. Gidley, of Cron Chemical Corp.; Secretary—Gordon A. Wilson, of NL Chemicals; Treasurer—Mike Falcone, of Hempel Coatings (USA), Inc.

The technical presentation was given by Mark F. Dante, of Exxon Chemical Co., whose topic was "ISOPARAFFINS IMPART BENEFICIAL PROPERTIES TO COATINGS THROUGH LOW SURFACE TENSION." Mr. Dante is a member of the New York Society.

The speaker reviewed the relationship between surface tension and neat solvent blends in coatings. Mr. Dante said isoparaffins can alter surface tension, thereby improving wettability of coatings and reducing foaming in an aqueous system. A slide presentation was used for illustration purposes.

SANDRA S. GIDLEY, *Secretary*

LOS ANGELES JUNE

"Eco-Hysteria, Eco-Politics And Eco-Logic"

James D. Hall, of Sinclair Paint Co., was elected to the Society Board of Directors.

Golden Gate Society Technical Committee Chairman Robert D. Athey, Jr., of Athey Technologies, was the meeting's technical speaker. Dr. Athey's presentation was titled "ECO-HYSTERIA, ECO-POLITICS AND ECO-LOGIC."

The speaker discussed the water pollution problem and, using guidelines from a book written by Congressman Jim Wright over 20 years ago, described the seven different kinds of technical problems in water pollution. Dr. Athey also examined the

politics involved with each problem in light of recent news and the seriousness of each problem.

JAMES F. CALKIN, *Secretary*

NEW YORK.....APR.

"Foam Stability"

The meeting's speaker was Robert Patterson, of PQ Corp., whose topic was "THEORIES OF FOAM STABILITY AND EFFECT OF ANTIFOAMS."

Dr. Patterson gave background information on where foam exists and some causes and problems. His presentation covered the thermodynamics of the bubble system and the relationship of the Gibbs Free Energy Equation. A demonstration of bubbles and angles in a special cage was given and the use of silica as a defoamer was discussed.

ARTHUR A. TRACTON, *Secretary*

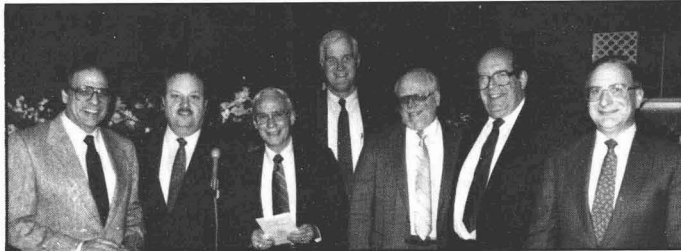
NEW YORK.....MAY

"Aliphatic Epoxy Resins"

A moment of silence was observed in memory of Bernard Leptselter, of R&A Specialty Chemical Corp., Inc., who died recently.

Federation guests in attendance included Federation President-Elect James E. Geiger, of Sun Coatings, Inc., and Federation Executive Vice President Robert F. Ziegler.

Mr. Geiger discussed the Office Building Committee's consideration of purchasing a building for the Federation. Mr. Ziegler reviewed the 1987 Annual Meeting and Paint Show (AM & PS) held in Dallas, TX; the 1988 AM & PS to be held in Chicago, IL, on October 19-21; Spring Week; seminars; scholarships; the Regulatory UPDATE insert in the JOURNAL OF COATINGS TECHNOLOGY; the budget; the Federation Series on Coatings Technology booklets; and the Federation staff in Philadelphia, PA.



25-YEAR MEMBERS—CSCT members receiving 25-Year Pins from Victor Willis (third from left) are: George Scarpelli, Thomas R. Drucker, Charles W. Lechner, James M. Willard, Herman L. Patt, and Ray J. Parenti

The officers elected for 1988-89 were: President—Irwin H. Young, of Jesse S. Young Co., Inc.; Vice President—Arthur A. Tracton, of Hempel Coatings (USA) Inc.; Secretary—Roger P. Blacker, of Whittaker, Clark & Daniels, Inc.; and Treasurer—Jeffrey C. Kaye, of MacArthur Petro & Solvent Co.

Saul Spindel, of D/L Laboratories, Inc., will continue to serve as Society Representative.

Nominated and elected to serve two-year terms on the Society Board of Directors were: Richard E. Max, of Hartin Paints & Filler Corp.; Armand J. Stolte, of NL Chemicals; and A. Wayne Tamarelli, of Dock Resins Corp.

Moe Bauman, of Bauman & Co., Inc., was elected a Society Honorary Member.

Society member Edward G. Bozzi, of CIBA-GEIGY Corp., was the meeting's technical speaker. Dr. Bozzi's topic was "UNIQUE ALIPHATIC EPOXY RESINS AND HARDENERS."

The speaker addressed some of the individual problems associated with epoxies, including exterior durability, flow/viscosity, and corrosion resistance. Dr. Bozzi also offered resins systems and data which showed product advantages.

Q. Can you use these systems on aluminum and steel?

A. Yes, but thickness may vary.

ARTHUR A. TRACTON, *Secretary*

PIEDMONT.....MAY

"Cosolvent Efficiency"

Frank C. Schaffer, of Rohm and Haas Co., was elected Technical Committee Chairman.

Linda S. Smith, of Rohm and Haas Co., discussed "PREDICTING COSOLVENT EFFICIENCY FOR COALESCING LATEX FILMS."

Dr. Smith examined the use of the Minimum Filming Temperature (MFT) graph



HALF CENTURY CLUB—Victor M. Willis (c) is the presenter of 50-Year Pins to Chicago Society members Milton A. Glaser (l) and Albert E. Counter

and equation and how they can be used to predict the efficiency of various coalescing aids. She also described how a MFT apparatus is used to measure the formability of a latex or to determine the lowest temperature at which latex particles will still flow together to form a film.

Dr. Smith was instrumental in the development of the MFT equation.

FOREST G. FLEMING II, *Secretary*

PIEDMONT.....JUNE

"Corrosion"

Ruby Johannesen, of Southchem, Inc., was elected Treasurer for 1988-89.

Twenty-five-Year Certificates were presented to Ralph E. Hall, of Reliance Universal, Inc., and Bobby Beane, of Lilly Co.

Forest G. Fleming II, of Reliance Universal, Inc., accepted the Federation's Membership Award Plaque, which was given at the FSCT Spring Board of Directors meeting recognizing the largest increases in Society membership.

The Educational Committee will participate in the American Chemical Society's Annual Symposium, in Winston-Salem, NC, in October, 1989. The Committee's topic is "Low Temperature Cure."

Southern Society member Michael C. McLaurin, of Buckman Laboratories, Inc., was the meeting's speaker. His subject matter was "CORROSION AND ITS CONTROL WITH NON-LEAD, NON-CHROMATE CORROSION INHIBITIVE PIGMENTS."

The speaker reviewed the electrochemical corrosion process and discussed the various methods of controlling and preventing corrosion with anodic and cathodic barrier coatings. Mr. McLaurin's technical data was obtained from recent salt fog studies that compared leading non-lead/non-chromate inhibitors to zinc chromate and basic lead silico chromate in long oil alkyd primers. In addition, he discussed how an effective resistant coating system can be formulated with reactive pigments.

FOREST G. FLEMING II, *Secretary*

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Pictorial Standards of Coatings Defects		
_____	Complete Manual	(\$90)
_____	Individual Standards (\$3 ea., plus \$3 per photo as noted)	
_____	Adhesion (1)	Blistering (4)
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People

William J. Weiskopf has been named Account Manager/Southern California for the E.T. Horn Co., La Mirada, CA. His primary responsibility will be to service the paint, coatings, ink, and electronics businesses in the Southern California area. Prior to joining E.T. Horn, Mr. Weiskopf was employed by Unocal Corp. He is a member of the Los Angeles Society.

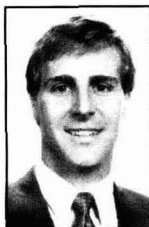
The newly formed Coating Polymers and Resins Division of Reichhold Chemicals, Inc., Pensacola, FL, has named **Laurence Loh** its President. Formerly President of the company's Chemical Coatings Division, Dr. Loh will head the new division, which is comprised of the former Newport and Chemicals Coatings Divisions of Reichhold.

The Wheelabrator Corp., Peachtree City, GA, has appointed **Ronald Whitaker** to the newly created position of President—North American Operations. Prior to joining the company, Mr. Whitaker was President of Johnson Filtration Systems, a Wheelabrator Technologies, Inc., company.

The appointment of **Ralph F. Sullivan III** as a Sales Representative in the Southeast for the Humko Chemical Division of Witco Corp., New York, NY, has been announced. In his new position, Mr. Sullivan will represent Humko in North Carolina, Virginia, and West Virginia. He will be based at company offices in Charlotte, NC.

In addition, **Victor E. Neatrou, Jr.** has been promoted to the newly-created position of Divisional Vice President and Assistant General Manager of the Kendall/Amalie Division of Witco. At division headquarters in Bradford, PA, Mr. Neatrou will be working closely with **Henry P. Pruch**, Corporate Vice President and General Manager, who is due to retire early next year.

DeSoto, Inc., Des Plaines, IL, announced that its Board of Directors has elected three new corporate officers who will report directly to **Richard R. Missar**, DeSoto's Chairman, President, and Chief Executive Officer. The officers are: **Wesley L. Anderson**—Vice President for Coatings and Polymers; **T. Farrell Shofteit**—Vice President for Specialty Products; and **Harvey L. Beeferman**—Vice President for Corporate Development and Technology.



W.J. Weiskopf



L. Loh



J.L. Scott



A.L. Mantz

John L. Scott, Vice President and Technical Director for South Florida Test Service, Inc., a subsidiary of Atlas Electric Devices Co., Miami, FL, is a 1988 recipient of ASTM's (American Society for Testing and Materials) Award of Merit. The award, presented by Committee G-3 on Durability of Nonmetallic Materials and Committee E-44 on Solar and Other Renewable Energy Conversion, cited Mr. Scott for his 20 years of meritorious service and leadership through contributions to the development of standards and administrative guidance, during the formative years of both committees. Accompanying the Award of Merit is the honorary title of Fellow of the Society. Mr. Scott is a member of the Southern Society.

Chemcentral Corp., Chicago, IL, has announced the following appointments: **R.B. Reeves**—General Manager, Atlanta, GA; **Tim McCarty**—Industrial Salesman, Toledo, OH; and **Thomas N. Wolk**—Sales Manager, Dallas, TX.

Bob Beier has been named Branch Manager at the Phoenix, AZ, office of Ribelin Sales, Inc., Dallas, TX. In his new capacity, Mr. Beier will be responsible for Ribelin's operations in Arizona, New Mexico, and El Paso, TX.

Also, **John F. Channing** has been appointed as the Houston Branch Manager. He will be responsible for sales throughout central and southern Texas.

Furane Products Co., Los Angeles, CA, has recently named **John Currie** to the position of Technical Service Specialist/General Purpose Epoxy Molding Compounds. Mr. Currie has been employed by the firm for over 25 years.

A.L. Mantz has joined the technical staff of Zinchem, Inc., a subsidiary of Wm. Zinsser & Co., Somerset, NJ, as Senior Polymer Chemist. His responsibilities will include the development of emulsion and solution polymers for the printing ink and coatings industry. Dr. Mantz comes to Zinchem after serving a 30-year career with Union Carbide Corp.

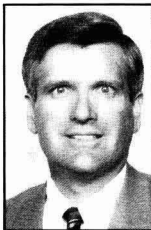
Duane Fudge has joined Betz Laboratories' Coil Container Treatment Division, Southampton, PA, as an Engineer. In his new position, Mr. Fudge will be responsible for providing technical support to the division's coil sales force.

Angus Chemical Co., Northbrook, IL, has expanded its sales force by adding **Nina A. Loeffler** and **Ann M. Druffner** as Specialty Chemicals Technical Representatives. Ms. Loeffler will be responsible for sales in the states of Arkansas, Colorado, Kansas, Nebraska, Nevada, Oklahoma, and parts of California, Texas, and Missouri. Connecticut, Rhode Island, and parts of New York and New Jersey will be under Ms. Druffner's responsibility.

Also, **Thomas L. Johnson** has joined Angus as a Sales Service Representative. In this newly-created position, Mr. Johnson will be responsible for helping to develop, implement, and maintain a sales service program that is responsive to the needs of the firm's customers.

The appointment of **Peter Hassall** as Product Manager/Agricultural Paints has been announced by Newtown Industrial Paint Ltd., Staffordshire, England. He will be responsible for the marketing and development of the firm's agricultural coatings. Mr. Hassall is a member of the Birmingham Paint, Varnish and Lacquer Club.

Jim McDerby has been appointed Vice President of Sales for F.R. Hall, Inc., St. Louis, MO. He will be responsible for the sales and marketing functions of the firm. Mr. McDerby joined F.R. Hall in 1984 and has been active in the chemical specialties industry since 1966. His most recent position with the company was Sales Manager. Mr. McDerby is the immediate Past-President of the St. Louis Society.



LaDonna Howard has been promoted to the position of Customer Service Manager at the Wichita Branch office of Unocal Chemicals Division, Unocal Corp., Schaumburg, IL.

Robert D. Kelly, Jr., has joined the staff of Volstatic, Inc., Florence, KY, as Sales Engineer for its western region. His initial responsibility will be to coordinate sales activities of the company's Solid-spray product line in the San Diego and Los Angeles metro areas.

Hoechst Celanese Corp., Somerville, NJ, has announced the appointment of **Utz Felcht** as President of the Hoechst Celanese Advanced Technology Group, Executive Vice President of Hoechst Celanese Corp., and a member of the Chairman's Committee. Among his many new responsibilities, Dr. Felcht will oversee the firm's research projects, technological developments, and new business developments. **James J. Bigham**, previous President of the Advance Technology Group, will remain responsible for Hoechst Celanese Japan, Ltd. and for the company's business interest in Celanese Mexicana, S.A.

Hercules Incorporated, Wilmington, DE, has appointed **Douglas C. Parsons** as Account Supervisor in the Midwest for its Coatings & Additives Group. Mr. Parsons has held several posts in sales of coatings and water soluble polymers since joining Hercules in 1981. He will be headquartered in Naperville, IL.

Carl M. Kaltwasser has accepted the position of Systems Group Manager, and **Frederick C. Spindler** has been named Eastern Regional Manager for the Jervis B. Webb Co., Farmington Hills, MI. Mr. Kaltwasser's appointment follows the retirement of **Ralph Holmberg**, who held the position of Systems Group Manager for nine years.

Richard Raabe, Founder and President of Raabe Corp., Milwaukee, WI, has retired after 37 years of service to his company. Mr. Raabe started the company in his garage in 1951, supplying paint to local auto body repair shops. The firm now occupies a 52,000 sq ft manufacturing plant. Following Mr. Raabe's retirement, **Daryl Raabe** and **Kent Raabe** were named President and Chairman, respectively.

The Environmental and Occupational Safety Department and the Environmental and Safety sections of the Engineering Department of Ashland Chemical Co., Columbus, OH, have combined forces to respond to changes associated with environmental and safety issues. The following appointments have been made as a result of this action: **Dick Toeniskoetter**—Manager/Environmental and Occupational Safety; **Glenn Hammer**—Manager/Environmental Engineering; **Don Warren**—Manager/Industrial Hygiene and Safety; and **Paul Horstmann**—Manager/Product Information Services.

Red Devil Coatings, Mt. Vernon, NY, has appointed **Rick Stohr** as Vice President—Marketing. He most recently served as Vice President and Director of Marketing for the Sprayon, Duplicolor, and Rubberset Division of Sherwin-Williams Co.

Darrel Campbell has joined the staff of the Global Specialty Chemicals Group of Johnson Wax, Racine, WI, as Managing Director/North American Region. He replaces **Dennis E. Schendel**, who has been named to a new position at Global.

Obituary

Edmund O. Cummings, retired Professor from High Point College, High Point, NC, died July 5. He was 90 years old.

A native of High Point, NC, Dr. Cummings graduated from the University of North Carolina at Chapel Hill. He received the Ph.D. degree in organic chemistry from Massachusetts Institute of Technology, where he graduated Phi Beta Kappa. He was the head of the chemistry department for 20 years at High Point College, where he was a Professor from 1928 to 1967. At that post, Dr. Cummings worked closely with the local coatings industry and emphasized the study of polymer and coatings chemistry to his students. His tenure produced countless number of coatings chemists for the Piedmont area and beyond.

Leon Greenstein has been named Chairman of The Mearl Corp., New York, NY. Dr. Greenstein had served as Vice Chairman of the company since 1975.

Robert C. Slagel has been named Manager of Marketing and Commercial Development for the Chemical Products Division of Union Camp Corp., Wayne, NJ. He joined Union Camp in 1979 as Technical Director for the division. Succeeding Dr. Slagel is **Nelson E. Lawson** as Technical Director. He will be based at the firm's Savannah, GA, location.

In addition, **Thomas C. Eckhardt** has been promoted to Sales Manager for Adhesive Resins. Prior to joining Union Camp in 1981, Mr. Eckhardt was a Sales Representative for Hercules.

Croda Inks Corp., Niles, IL, has announced the following promotions at its Product Development Laboratory in Atlanta, GA: **Harmon C. Hayes**—National Sales Manager; **Paul J. LeBlanc**—Product Manager, Liquid Inks; and **Mark J. Wiedmann**—National Manufacturing Manager.

The Board of Directors of Air Products and Chemicals, Inc., Allentown, PA, has elected **Frank J. Ryan** as its President and Chief Operating Officer. The title had been held by **Dexter F. Baker**, currently the company's Chairman and Chief Executive Officer. In other executive moves, **J. Robert Lovett**, currently President, Air Products Europe, succeeds Mr. Ryan as Group Vice President/Chemicals; and **Harold A. Wagner**, presently Vice President/Business Division, Chemicals Group, becomes President, Air Products Europe.

Dr. Cummings was instrumental in the founding of the Piedmont Society of the Federation of Society for Coatings Technology; and in recognition of his dedication to the Society and the Federation, he was elected a Federation Honorary Member. He also served as a member of the National Paint & Coatings Association and the American Chemical Society.

He is survived by his wife, Marie; a daughter, Anne C. Meade; a brother, C.V. Cummings; a sister, Mrs. Evelyn Wands; and three grandchildren.

Harry E. Mattin, founder and Chairman of The Mearl Corp., New York, NY, died June 16. He was 92 years old.

Meetings/Education

Quality Control and Environmental Control to Be Explored During Short Courses Scheduled by Kent State University

The Coatings and Rheology Laboratory of Kent State University, Kent, OH, has scheduled two new fall short courses.

"Environmental Control and Emission Monitoring in the Coatings and Polymer Industries," to be offered on October 24-26, will present established and new developments in industrial air monitoring. The course is designed for technicians and managers who have recently been assigned emission assessment responsibilities and monitoring duties. It will also aid those involved in plant design and startup where modeling and monitoring are part of the application procedure.

The principal lecturer is Dr. Robert F. Conley, of Mineral and Resource Technology. Emphasis will be placed on plant emissions and worker environmental air in which volatile organic compounds and other toxic gases are emitted. State and federal regulations on testing procedures and record keeping requirements, equipment and its calibration, and data reporting will be discussed. Special topics include difficult system analysis, sampling on abatement devices, and industrial hygiene problems. Equipment demonstrations, including a variety of certification testing and continuous emission monitors, will be performed.

"Coatings and Polymer Quality Control" will be presented November 14-16. The coordinator for this new program is H. Earl Hill, Coatings Consultant, who will be assisted by ten experts in quality control.

Topics to be discussed include fundamentals of quality control as related to product improvement for coatings and



polymers, terminology, charting techniques, software availability, and the ease of applications.

The course is designed for individuals in coatings, adhesives, elastomers, plastics,

and the chemical industries who are interested in the practical application of statistical quality control concepts. This includes individuals in research, product development, engineering, pilot plant, manufacturing, technical service, and marketing. The techniques would also appeal to managers, supervisors, engineers, technicians, and other persons with little or no statistical training who are interested in the application of quality control to achieve company-wide quality improvement.

Information on both courses may be obtained by writing Carl J. Knauss, Chemistry Department, Kent State University, Kent, OH 44242.

Macbeth to Sponsor Seminar on Fundamentals of Color

"The Fundamentals of Color," a color seminar conducted in various parts of the country each year by Macbeth, a Division of Kollmorgen Corp., has been scheduled.

This two-day meeting is structured to provide attendees from many industries with an understanding of the problems and solutions associated with the measurement, specification, and control of color. The presentations are aimed at those involved in the design, production, or quality control of products for which color is important.

The first day of the seminar is devoted to lectures and practical demonstrations in the use of visual standards, controlled lighting and viewing conditions, and color measurement instrumentation.

The fee for the first day of \$215/U.S. per person covers reference material, workbook, and lunch. There is no charge for the second day.

Locations and dates for the seminars are, as follows: Sept. 19-20—Charlotte, NC; Oct. 13-14—San Jose, CA; Oct. 17-18—Grand Rapids, MI; Nov. 14-15—King of Prussia, PA.

Additional information and application forms can be obtained from Elaine Tito, Macbeth, Little Britain Rd., P.O. Box 230, Newburgh, NY 12550-0382.

Industrial Safety Seminars Scheduled by Du Pont Co.

The Du Pont Company, Wilmington, DE, will sponsor a series of three industrial safety seminars to be held in the fall of 1988.

"Managing Safety: Techniques That Work for the Safety Pro" is intended to teach techniques that have been successful in reducing accidents. The seminar identifies specific actions and programs that safety professionals can use to improve safety. Dates and locations are: Sept. 13-15—Wilmington, DE; Oct. 4-6—San Francisco, CA; Oct. 18-20—Orlando, FL; and Nov. 29-Dec. 1—Wilmington.

"Managing Safety: Techniques That Work for Line Supervisors" is designed for new or experienced first- and second-line supervisors. It offers practical tools

and strategies that have a positive effect on safety performance. Scheduled dates and locations are: Sept. 20-22—Wilmington; Sept. 27-29—Toronto; Oct. 11-13—Houston; Nov. 15-17—Wilmington; and Dec. 6-8—Wilmington.

"Managing Safety: Techniques That Work for Operations Managers" is designed for production superintendents, plant managers, and site managers. This seminar concentrates on systems to improve safety performance. Dates and locations are: Oct. 18-19—Charlotte, NC; Nov. 30-Dec. 1—Toronto; and Dec. 13-14—Wilmington.

For more information, contact Du Pont Safety Services, Barley Mill Plaza, PI9-1104, Wilmington, DE 19898.



"Safety in the Paint Industry" Video Offered by Pacific Northwest Society

The Vancouver, British Columbia, section of the Pacific Northwest Society has produced a 57-minute video covering a broad range of aspects related to safety during the manufacture of coatings. Designed as a thought-provoking film for use in training production and technical staff, the video was produced using home video equipment and features some talented

members of the Society as principal characters.

The scenario used is a tour of a paint plant by the firm's general manager and production manager, who discuss major potential safety hazards, with a view to setting up a new safety program for the company. Their discussion covers pigments, resins, solvents, additives, the use

of PPE and MSDS, high speed stirrers, fork lift trucks, labelling of containers, and fire safety procedures. The slogan, "Think Safely—Think Safety" is used throughout the video to encourage viewers to focus on that during the workday.

The information is portrayed in a fairly light, and sometimes humorous, manner, and all the incidents in the video are based on actual accidents which were reported to the Society during a pre-script survey.

In addition to the video, a leaflet has been produced for distribution to viewers as a permanent, handy reference of the major hazards covered by the video.

The cost of \$65 (U.S.); \$75 (Canada) includes the video, plus 10 copies of the leaflet, as well as all handling and shipping charges. (Additional leaflets are available at \$1.00 each.)

To purchase the video, please mail a check with the order to: Valerie Braund, c/o General Paint, 950 Raymur Ave., Vancouver, BC V6A 3L5, Canada. Make checks payable to the Pacific Northwest Society.



Fall Courses Announced by Applied Color Systems

Applied Color Systems Inc., Princeton, NJ, has announced its fall schedule of color seminars. These seminars are designed for management and technical personnel involved in industrial application of color to products. Focus will be on practical color problem solving in industrial applications with an eye towards providing fresh insights on new techniques. Topics covered include: colorimetry and factors affecting color; spectrophotometry and metamerism; colorant characteristics and elements of formulation; color differences; and Kubelka-Munk Turbid Media Theory Application.

On October 12-14, the seminar will be held in New Orleans, LA, and on November 29-30, the location is Greenville, SC. Registration fee for both two-day and three-day seminars is \$395. Lecturer for the program is Ralph Stanzola, President of Industrial Color Technology and a recipient of the FSCT Armin J. Bruning Award for his contributions to color science.

Additional details may be obtained by contacting Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543.

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Coatings Education

In keeping with its objectives as an educational organization, the Federation of Societies for Coatings Technology annually awards scholarships to schools where coatings technology is part of the curriculum. As part of a continuing series, the JCT will focus on these schools and highlight details of their coatings programs. The Federation is pleased to be associated with these universities and their efforts in training future members of the coatings industry.

Polymers and Coatings a Major Department At North Dakota State University

The Polymers and Coatings Department at North Dakota State University (NDSU), Fargo, ND, was established in 1962 under the tutelage of Al Rheineck, the program's first Chairman. The department offers B.S., M.S., and Ph.D. Degrees in Chemistry with a major in Polymers and Coatings.

History

In 1906, Edwin Ladd (later a U.S. Senator) started a paint testing program at North Dakota Agricultural College (now NDSU) and employed and trained students to test composition and weatherability. He also was responsible for equipping a paint testing facility. In the early and mid-1920's, five to eight graduates per year were being trained in paint technology, and by the end of the decade the average was 18 per year. By the 1950's NDSU had a Department of Paints, Varnishes and Lacquers in the School of Chemical Technology. At this time the program was under the leadership of Wouter Bosch and offered an M.S. Degree. The Department of Polymers and Coatings, with Dr. Rheineck as Chairman, was initiated in 1962 and offered M.S. and Ph.D. Degrees. In 1972, Zeno W. Wicks, Jr., became Department Chairman. During his tenure, Dr. Wicks evolved a course in coatings science which has been taught as far away as eastern China. When Dr. Wicks retired in 1983, current Department Chairman Frank N. Jones took over the reins of leadership.

Objectives

The basic mission of the department's program, according to Dr. Jones, "is to offer students a high quality scientific and general education coupled with up-to-date professional training in coatings science." This educational foundation in polymer chemistry can be applied in a number of related fields including plastics, microelectronics, composites, and petroleum recovery, in addition to coatings and polymers.

Research Support

Industry/university cooperative research is a part of the polymers and coatings pro-

gram at NDSU. The goal of NDSU is to encourage industry to support university research and to invite researchers to work on subjects relevant to industry. Current supporters of the NDSU research program include: Akzo; American Cyanamid; Amoco; Beckers; CIBA-GEIGY Corp.; Control Data; Du Pont Co.; Exxon Corp.; H.B. Fuller Co.; Hitachi; Hüls; IBM; IMC; 3M Co.; Midland-Dexter; Monsanto Co.; PPG Industries, Inc.; Sherwin-Williams Co.; Union Carbide Corp.; and Valspar Corp.

Department research also is supported by the Environmental Protection Agency and the National Science Foundation. The department was aided by a grant from the National Science Foundation to promote basic science. About \$800,000 has been committed to a program in "Laser Spectroscopy and Polymers."

Industrial Advisory Committee (IAC)

The department works closely with the coatings and petroleum industries and with their suppliers and customers to assure relevance of the programs being offered at

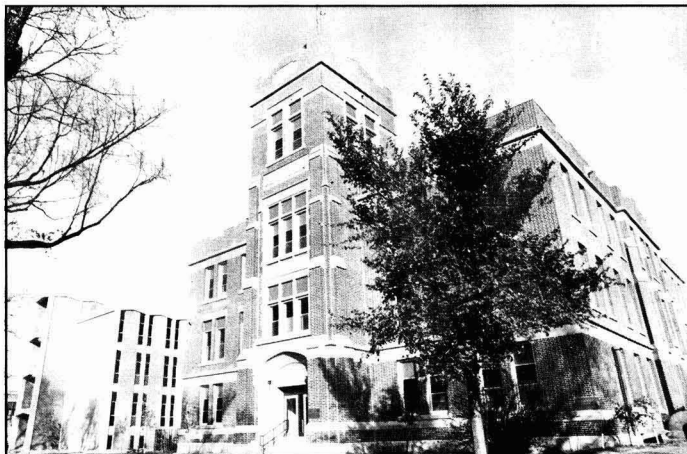
NDSU. The IAC is composed of 25 prominent industry people who meet annually for three days with staff and students. The committee, much like a board of directors, offers valuable advice on course content and research objectives, and critiques the program and provides assistance ranging from technical information to job placement advice.

Most major companies in the field are represented on the IAC.

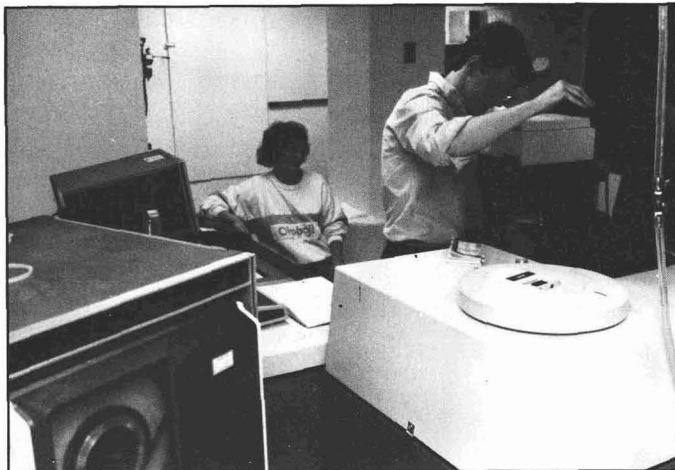
Undergraduate Program

Undergraduate candidates for the B.S. Degree in Chemistry with a major in Polymers and Coatings have two options available. They can choose an American Chemical Society approved program or a program which permits more electives. Undergraduate Mechanical Engineering majors also may elect a polymers and coatings option.

Courses in polymers and coatings may be taken starting in the junior year. These courses include lectures on theoretical aspects of the subject and laboratories stressing the practical aspects of polymer synthe-



DUNBAR HALL AND LADD HALL—The sites of the Polymers and Coatings and Chemistry Departments at NDSU



SPECTROSCOPY LABORATORY—Students make use of the coatings FTIR spectroscopy laboratory at NDSU

sis and of preparation and testing of coatings. In recent years, the field of polymers for petroleum recovery has become a substantial part of the department's research. A course in petroleum recovery also is offered.

Each year, 25-30 students who graduate with B.S. Degrees in Chemistry or Mechanical Engineering receive coatings training.

About 40 scholarships of \$700, \$1,000, \$1,200, and \$2,000 per year are available to undergraduates each year. Monies are provided by the Federation of Societies for Coatings Technology, the Northwestern Society for Coatings Technology, the Chicago Joint Education Committee, private industry, and individuals. Entering freshmen and transfer students are eligible for the awards and are urged to apply. Scholarship renewal depends upon continued interest in polymers and coatings, satisfactory progress in coursework, and availability of funds.

In addition, an undergraduate summer research program in polymers and coatings, sponsored by PPG Industries, Inc., is available. Summer research appointments are available for chemistry majors between the junior and senior years who intend to pursue graduate studies in Chemistry and have a potential interest in polymer science. Research project examples include: FTIR Spectroscopy of Polymers and Coatings; Synthesis of Water-Borne Polymers; Synthesis and Reactivity of Catalysts and Crosslinking Agents; and Synthesis and Reactivity of Functional Oligomers. The stipend is \$2,000 for 10 weeks.

Graduate Program

The Department of Polymers and Coatings offers courses of study leading to the

M.S. and Ph.D. Degrees. Graduate courses of study include: "High Polymers"; "Coatings I, II, and III"; "Polymers in Petroleum Recovery Processes"; "Coatings Laboratory"; "Physical Chemistry of Coatings"; "Organic Chemistry of Coatings"; "Modern Methods of Polymer Characterization"; "Research in Industry"; "Photochemical Aspects of Coatings"; "Physical Chemistry of Polymers I and II"; and special topics.

Graduate students are generally supported on either a teaching assistantship (TA) or a research assistantship (RA). The stipend for a TA is \$805/month and for a RA the stipend is \$780/month and increases every year. In all cases, tuition fees are completely waived for TA's and RA's. Thus, net stipends for the calendar year are generally in the range of \$9,360 to \$9,660.

Continuing Education

At the request of the coatings industry NDSU started a program of intensive short courses 10 years ago. The integrated courses are taught by professional teachers and have become a substantial part of the department's educational mission.

Three intensive short courses are offered in June and include: "High Solids," "Coatings Science," and "Radiation Curable Coatings."

Research Facilities

Physical facilities for carrying out chemical research include nearly 90,000 square feet of floor space. A modern chemistry library contains complete sets of over 100 journals and approximately 10,000 volumes as well as an inventory of film cassettes and audio and taped short

courses. Graduate students and faculty have round-the-clock access seven days a week to the chemistry library.

Research instrumentation in the department includes: two UV-visible spectrophotometers, two FTIR spectrometers with all accessories for coatings research, high performance liquid chromatographs, a Dynamic Mechanical Analyzer, a tunable pulsed dye laser, an atomic absorbance spectrometer, a high power pulsed dye laser system, a 400 MHz multi-nuclear FT-NMR, a Fourier transform mass spectrometer (FT-MS), a spectrofluorimeter, computer facilities, a powder x-ray diffractometer, x-ray fluorescence unit, an ESR spectrometer, differential thermal analyzer, 90 MHz proton NMR, and numerous gas chromatographs. On-campus facilities provide routine access to GC-MS, ultra-high resolution mass spectrometry, and scanning and transmission electron microscopes.

Faculty

The Polymers and Coatings Department faculty has extensive experience in the coatings and chemical industries. Staff members possess theoretical expertise in photochemistry, surface FTIR spectroscopy, polymer characterization, polymer rheology, surface chemistry, organic chemistry of reactive polymers, and polymer synthesis.

Faculty members in the Polymers and Coatings Department include: Chairman Frank N. Jones (Professor, Ph.D., Duke University, 1962; Postdoctoral, Duke University, 1962; and Postdoctoral, Massachusetts Institute of Technology, 1962); J. Edward Glass (Professor, Ph.D., Purdue University, 1964); S. Peter Pappas (Professor, Ph.D., University of Wisconsin, 1962; Postdoctoral, University of Wisconsin, 1962-63; and Postdoctoral, Brandeis University, 1963-64); and Marek W. Urban (Assistant Professor, Ph.D., Michigan Technological University, 1984; and Postdoctoral, Case Western Reserve University, 1984-86).

Other active faculty are Emeritus Professor Wicks and Adjunct Professor Loren W. Hill.

NDSU alumni are now employed in professional and managerial positions at most of the major coatings producers and at many other companies which produce or use polymers. "The mission of our department is to educate students who will be productive in the polymer and coatings communities," said Dr. Urban.

Expansion of the Polymers and Coatings Department at NDSU looms in the near future. In addition to doing research on traditional paints and coatings, the Department's focus is on the new, high technology, more sophisticated coatings and the problems surrounding them.

Literature

Corrosion Resistant Mixer

A four-page, full-color brochure describes a firm's full line of stationary fluid mixers. Individual segments of the mixers are constructed of reinforced thermoset plastic and offer temperature resistance up to 250°F and pressure resistance up to 150 psi. For a copy of Bulletin B-594, "The Lightnin® Polychem™ Inliner Mixer," contact Betty Felix at Mixing Equipment Co., 135 Mt. Read Blvd., Rochester, NY 14603.

Polyurethane Technology

A new four-page color chip brochure introduces the second generation of polyurethane technology for the aerospace industry. Fifty-five standard colors are shown to represent the foundation for custom colors available in a firm's various product lines. For a copy of the Aerospace Finishes brochure, contact Akzo Coatings Inc., Akzo Aerospace Finishes, 20846 S. Normandie Ave., Torrance, CA 90502.

Storage Containers

A line of bulk liquid shipping and storage containers with a special mirror finish is described in literature. The container's mirrored finish assures a non-stick, non-stain surface. Additional information on the Sta-Brite™ Jumbo Bin container can be obtained by writing to the Clawson Tank Co., 4701 White Lake Rd., Clarkston, MI 48016-0350.

Instruments

A four-page flyer describing wet and dry film thickness gages, pin hole detection instruments, a ferrite detector, and an "Instrumentation for Coatings" handbook is now obtainable. For more information, contact Frank Reuter, Vice President/Marketing, Zorelco Ltd., P.O. Box 25500, Dept. D-23, Cleveland, OH 44125.

Aluminum Pigments

A 12-page booklet detailing the development and applications of leafing aluminum pigments is now available. Leafing aluminum pigments are used to create metallic effects and provide barrier protection in paints, coatings, plastics, and printing inks. Write to Silberline Mfg. Co., Inc., R.D. 2, Hometown, Tamaqua, PA 18252 for more information.

Process Software

A software system designed to address product quality, customer service, and cost reduction concerns is described in literature. The CIMPRO Process Manufacturing Resource Planning (P/MRP) module reportedly offers manufacturers the capability to generate time-phased materials requirement plans using live data and lead times. For further information on Release 3.0 software, write DataLogix, 100 Summit Lake Dr., Valhalla, NY 10595.

Volt Power Supply

Technical information announcing the availability of a 250 volt power supply is now available. This power supply is intended to be a source of DC voltages for routine electrophoresis applications. More data on the HBE 250 Volt Power Supply is obtainable by contacting HBI, Haake Buchler Instruments, 244 Saddle River Rd., Saddle Brook, NJ 07662-6001.

Coatings Systems

A line of primers and topcoats for rigid, semi-rigid, and flexible plastics is being introduced in literature. To receive more information on Plastoflex® Coatings Systems, contact Akzo Coatings Inc., P.O. Box 7062, Troy, MI 48007-7062.

Vacuum Equipment

Ultrahigh vacuum equipment development and production capabilities are the topics of a full-color, eight-page brochure which has been published. The brochure includes a step-by-step explanation of a firm's manufacturing process for its vacuum products and the development of its vacuum products line. To receive a copy of the PHI Ultrahigh Vacuum Capabilities bulletin, write Perkin-Elmer, Physical Electronics Div., 6509 Flying Cloud Dr., Eden Prairie, MN 55344.

Touch-up Bottle

Information is available on a .6 fluid ounce brush-in-cap plastic touch-up bottle for the application of custom color matched touch-up paints. The compact, shatter-resistant bottle is constructed of clear plastic to identify the color inside the container. For further information, write Raabe Corp., P.O. Box 23708, Milwaukee, WI 53223.

Software Package

New literature focuses on a complete software package to handle inventory, production, costing, OSHA compliance, formula analysis, and accounting on a PC. Write Pacific Micro, 6511 Salt Lake Ave., Bell, CA 90201 for details.

Color Analyzer

A color analyzer, which contains a hard drive reportedly capable of storing more than 1,000 color standards, has been introduced in literature. Created for the system is a software package designed to meet the statistical process control needs of the automotive industry. The system also is equipped with a 3½ inch floppy disk access for storage and to back up existing files in the hard drive. For more information on the Color Mate HDS™, contact Milton Roy, 820 Linden Ave., Rochester, NY 14625.

Corrosion Measurement System

An electrochemical system designed for corrosion rate analysis is introduced in a four-page, two-color brochure. The brochure incorporates a variety of menus and experimental plots to illustrate the capabilities of the system. For more information on "Model 342 Softcorr™ Corrosion Measurement System," contact EG&G Princeton Applied Research, Electrochemical Instruments Div., CN 5206, Princeton, NJ 08543-5206.

Salt Spray Chamber

A salt spray chamber which is available with 400 liter, 1000 liter, and as large as 2000 liter capacities is discussed in a technical data sheet. Write to T.J. Bell, Inc., 1340 Home Ave., Akron, OH 44310 for information on the Erichsen Model 606 salt spray chamber.

Nitrogen/Carbon/Sulfur Analyzer

A brochure detailing a fully-automated nitrogen, carbon, and sulfur analyzer is now available. The analyzer offers a simultaneous determination of the three elements. Also described are instrument specifications, sample size, measuring range, and reproducibility data. For a copy, write to HBI, Haake Buchler Instruments, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001.

Beta Backscatter

Literature which provides complete electrical and mechanical specifications of a system which combines a beta backscatter and magnetic induction principles is available. The system measures the plating thickness of nickel on printed circuit boards even through final layers of gold and rhodium, as well as tin-lead thickness, tin-lead composition, and gold and copper. For a copy of the bulletin on Beta-Min 1800, contact Chris Horvath, CMI International, 2301 Arthur Ave., Elk Grove Village, IL 60007.

Newsletter

A quarterly four-page newsletter designed to disseminate state-of-the-art information to coatings and linings personnel throughout the industry is obtainable upon request. Feature articles will include coatings failure analysis, maintenance painting practices, shop painting practices, removal/disposal of lead containing paints, and many other such topics. For information on how to receive free copies of *The Coating Consultant* newsletter, write KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15272.

Baking Coatings

Two new booklets on durable phenolic baking coatings for rigid metal substrates have been issued. A 12-page descriptive booklet provides information on the complete line of UCAR® heat-reactive and nonheat-reactive phenolic resins. The other booklet, a 36-page companion piece, provides formulation suggestions. Copies of the publications "Durable Phenolic Baking Coatings for Rigid Metal Substrates," designated F-60596, and "Formulations Suggestions," F-60675, can be obtained from Union Carbide Corp., UCAR Coatings Resins, Dept. L4489, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Gloss Measurement

Technical information is available on a 45°/0° spectrophotometer that simultaneously measures color and gloss on the same sample area. The system employs a fiber optic 60° gloss sensor in the sampling head to measure gloss while at the same time measuring color. For details on The Color Machine™, write Pacific Scientific Instrument Div., 2431 Linden Lane, Silver Spring, MD 20910.

Impeller

A high efficiency axial-flow impeller is featured in a new brochure. The laser-designed impeller uses specially contoured blades to provide well-directed axial flows. It reportedly can be effective at heights equal to three impeller diameters off the bottom or as low as 1/2 diameter off the tank bottom. Bulletin B-620 on the Lightning® A310™ impeller can be obtained by contacting Mixing Equipment Co., 135 Mt. Read Blvd., P.O. Box 1370, Rochester, NY 14603-1370.

Tapered Plug

A new leaflet which describes the use of a tapered plug, which when attached to a VOR rheometer, enables the user to make measurements of fluid viscosity at shear rates up to 60,000 s⁻¹ for paints and coatings. The literature is available from Bohlin Reologi, Inc., P.O. Box 6623, Edison, NJ 08818.

Mar Resistance

Information is available on a solution which reportedly has been proven effective in improving mar resistance and increasing apparent hardness in various systems including alkyds and oil-free polyesters. For details on Mar & Slip Solution (R-700-M), contact John Bradley, Cook Resins & Additives, P.O. Box 419389, Kansas City, MO 64141-6389.

Fine Tuned Formulating

Guesswork can cause sour notes in metallic coatings. So Silberline offers **Fine Tuned Formulating**, a precise way to match metallic pigments with individual coatings systems.

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Selector Guide

A chart featuring physical properties, application methods, cure response rates, and other pertinent data for each product in a specified product line is available upon request. For more information or a copy of Photoglaze® Selector Guide (Brochure #DS10-7008), write Lord Corp., Industrial Coatings Div., 2000 W. Grandview Blvd., P.O. Box 10038, Erie, PA 16514-0038.

Metering Pumps

A 16-page, full-color brochure highlights the features and benefits of a company's entire line of metering pumps. Charts showing delivery characteristics (plunger size, strokes per minute, maximum delivery, and maximum pressure), and materials of construction are illustrated for all models. For more information and a copy of Brochure B-645, write to Dick Walkley at Proportioneer™, 150 Elmgrove Pk., Rochester, NY 14624.

Pin Hole Detectors

A new series of pin hole detectors for determining protective coating flaws is discussed in a recently released data sheet. The model conforms to ASTM G6 specifications and is available in multi selectable and fixed voltage ranges. For more information, contact Frank Rueter, Marketing Manager, Zorelco Ltd., P.O. Box 25500, Dept. G-20, Cleveland, OH 44125-0500.

Fiber Drums

A 55-gallon fiber drum that is designed to reduce handling problems for customers using a line of solid-grade resins is discussed in a technical bulletin. In place of a bag-type liner, the fiber drum has a static conductive lining laminated to the interior of the drum. Thus, there is no bag to slip out during emptying, and the procedure for grounding the drum reportedly is simplified. Additional details may be obtained by contacting D.L. Hobart, Rohm and Haas Co., Independence Mall West, Philadelphia, PA 19105.

Densitometer

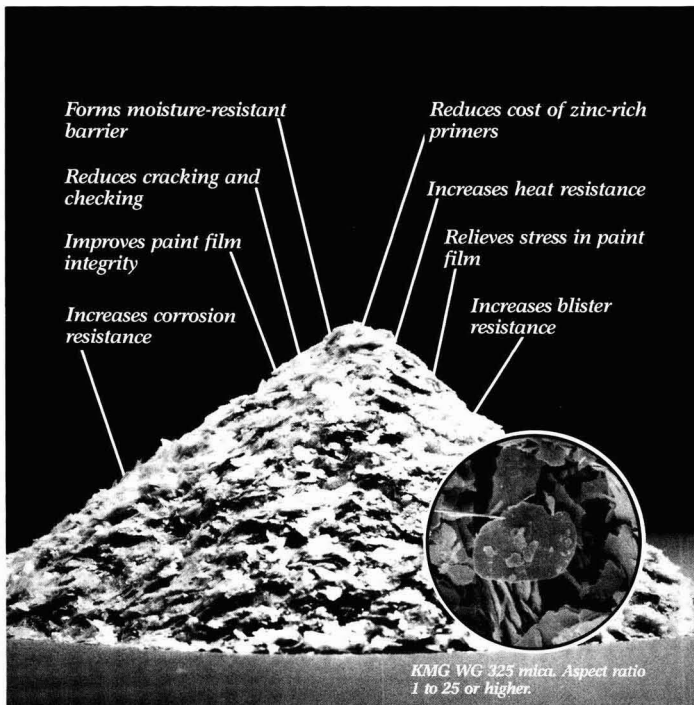
A four-page brochure explaining how a densitometer, along with its software package, is used for quantitative evaluation of electrophoretic separations that are run on various types of media. This system is designed to scan all types of autoradiographs where a large dynamic range and the ability to offset a high background density are essential. To receive a copy of this brochure, contact HBI, Haake Buchler Instruments, 244 Saddle River Rd., Saddle Brook, NJ 07662-6001.

Polyether Polyols

A new series of di- and tri-functional polyether polyols which supposedly improve formulations of two-component urethane coatings and adhesive systems has been introduced. The products are supplied at 100% solids, and are recommended as modifiers for existing systems or as the sole polyol in urethane, polyester, and alkyd coatings. Write to Robert Lieberman, Market Manager, Radiation Curing Chemicals, Henkel Corp., 350 Mt. Kemble Ave., Morristown, NJ 07960 for more information on the Polyol PHO-7000 Series.

Bonding Putty

Information has been published on a polyester bonding putty with a built-in catalyst indicator. The putty is blue in the uncatalyzed state and turns white when catalyzed properly. In addition, the product is shipped in a very flowable condition, thereby cutting down any loss in material when pouring from the container. Further information on Easy Flow Polyester Bonding Putty can be obtained by writing Dave Arment, Product Manager Composites Div., Cook Paint & Varnish Co., P.O. Box 419389, Kansas City, MO 64141-6389.



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Data Sheets

Five new technical data sheets on a firm's line of propylene glycol-based solvents for paints and coatings have been issued and are available upon request. The sheets cover: nonmethylene chloride paint strippers; MEK alternatives; using titanium dioxide more efficiently; improving corrosion resistance; and improving water-based coatings performance. Information on ARCOSOLV® P-series propylene glycol-based solvents can be obtained by contacting ARCO Chemical Dept., Marketing Communications Dept., 3801 West Chester Pike, Newtown Square, PA 19073.

Satellite Color Control

A two-page technical data sheet has been released which describes a satellite color control system for color matching, batch correction, waste re-use, and color quality control at remote locations. For a free copy of the data sheet, write: Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543.

Metering Pumps

Progressive cavity pumps with non-pulsating metered flows which are available in a wide range of sizes, from laboratory to heavy-duty production models, are the subject of recently released literature. All pumps feature a solid drive shaft with no valves to clog. For more information on Series Nemo® NE pumps, write Netzsch Incorporated, 119 Pickering Way, Exton, PA 19341-1391.

Liquid Epoxy Resin

A new multifunctional liquid epoxy resin with viscosity lower than conventional novolac resins is introduced in literature. The product is recommended for electrical encapsulation compounds, tank linings, industrial maintenance coatings, chemically-resistant flooring, and composites. More details on Epotuf® 37-152 may be obtained by contacting Tim Gregory, Project Chemist, Chemical Coatings Div., Reichhold Chemicals, Inc., P.O. Box 1433, Pensacola, FL 32596.

Treatment Program

Technical information is available on a three-pronged strategy which combines on-site analysis, on-line monitoring and control equipment, and coagulants, flocculants, and defoamers to produce customized treatment programs for all types of raw, waste, and process water systems. For more details on Drew's industrial water, fuel, and process treatment programs, write John R. Stinger, Manager/Marketing Communications, Drew Industrial Div., One Drew Plaza, Boonton, NJ 07005.

Flow Fractionator

A sedimentation field flow fractionator designed for the separation and characterization of particulates and macromolecules is introduced in literature. The system produces results in less than an hour with a 15% modal resolution. Additional details may be obtained by contacting Cynthia Thorne-Carter, Du Pont Co., External Affairs Dept., Wilmington, DE 19898.

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by Joseph W. Prane

— **Solvents**

by William H. Ellis

— **Coil Coatings**

by Joseph E. Gaske

— **Corrosion Protection
by Coatings**

by Zeno W. Wicks, Jr.

— **Mechanical Properties
of Coatings**

by Loren W. Hill

— **Automotive Coatings**

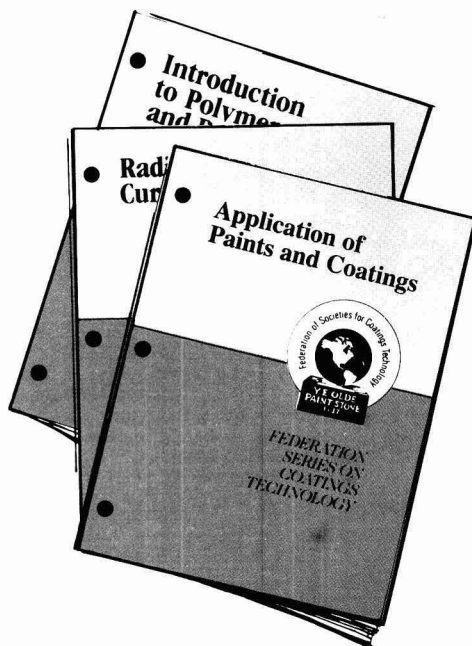
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Clifford K. Schoff*

— **Application of Paints
and Coatings**

by Sidney B. Levinson



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Book Review

SURFACE COATINGS-1

Edited by
Alan D. Wilson, John W.
Nicholson, and Havard J. Prosser

Published by
Elsevier Science Publishing Co.
52 Vanderbilt Ave.
New York, NY 10017 (1987)
xii + 273 pages, \$72.00

Reviewed by
Robert F. Brady, Jr.
Naval Research Laboratory
Washington, D.C.

This book contains seven review articles directed to individuals engaged in research, product development, or testing and evaluation of coatings. This volume focuses on organic surface coatings, but the editors state that they intend to include such related topics as metal finishing and surface analysis in future volumes.

The first chapter is a short survey of the types and uses of surface coatings, and touches on inorganic coatings, surface science, and instrumental methods for the analysis of surfaces and coatings.

A timely and comprehensive chapter is devoted to organo-tin antifouling paints, in which the chemistry, toxicology, and environmental aspects of the use of these paints is presented, and 250 references to the literature are included.

A very useful review is included of the factors which must be considered in the synthesis of binders for high-solids coatings which will have desired physical properties; examples are given for alkyd, polyester, epoxy, urethane, and acrylic coatings. Another chapter gives much information on the mechanisms of adhesion promotion, and discusses the proper methods for the incorporation of these materials into coatings; examples are given for adhesion promoters based on chromates, silanes, titanates, and zirconates. This chapter contains a useful index of the patent literature, and suggests many applications where performance would be increased by the use of adhesion promoters.

Several instrumental techniques are covered in detail. The use of plasma erosion as a laboratory accelerated weathering technique is discussed. This technique produces in minutes the changes that a carbon-arc weatherometer produces in hours, and data is presented which shows that the two methods produce similar results. The plasma erosion technique

is said to have considerable potential as an accelerated weathering method, and is said to be valuable in the evaluation of titanium dioxide pigments and finished coatings. A valuable chapter on the dynamic mechanical properties of coatings discusses five techniques that can be used to study the viscoelastic properties of coatings during cure (but not during application); the techniques capture information which is lost when only single-point viscosity and drying time readings are taken. The use of X-ray photoelectron spectroscopy to assess polymer and pigment surfaces and to analyze coatings failures is also described in detail.

The book is sturdily bound and well-illustrated, and contains a subject index. It will be a useful addition to the library of the coatings scientist.

INORGANIC AND ORGANOMETALLIC POLYMERS

Edited by
M. Zeldin, K. J. Wynne, and
H. R. Allcock

Published by
American Chemical Society
1155—16th St., N.W.
Washington, DC 20036 (1987)
xii + 512 Pages \$99.95

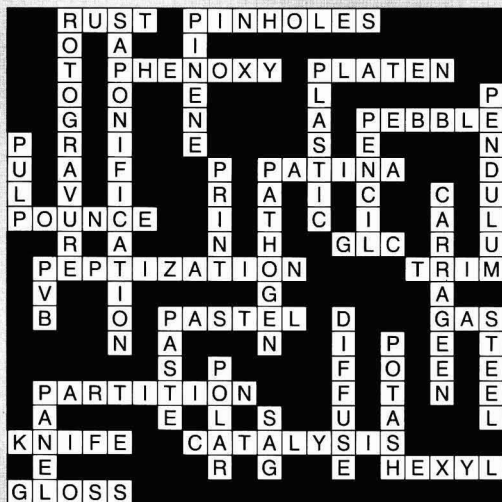
Reviewed by
Thomas J. Miranda
Whirlpool Corporation
Benton Harbor, MI

This book is a compilation of a series of papers which were presented at the American Chemical Society Symposium and published as ACS Symposium Series 360. The volume contains topical reviews and specialist reports on this growing field of investigation.

Topics covered include Polysilanes and Polycarbosilanes, Polysilazanes and Polysiloxanes, Polysiloxanes, Polyphosphazenes, Organoelement-oxo Polymers derived from Sol-Gel processes and Boron containing polymers. Many of these systems provide unique properties, such as heat resistance, electron transport and photochemical behavior. Analytical methods are also reported for characterization of these materials.

An interesting chapter by White, et. al., describes the preparation of metalloporphyrins which are electrocatalysts for the reduction of dioxygen.

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Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact FSCT, 1315 Walnut St., Philadelphia, PA 19107 (215-545-1506).

1988

(Oct. 19-21)—66th Annual Meeting and 53rd Paint Industries' Show. McCormick Place, Chicago, IL.

1989

(May 16-19)—Federation "Spring Week." Seminar on the 16th and 17th; FSCT Incoming Society Officers Meeting on the 18th; FSCT Board of Directors Meeting on the 19th. Los Angeles Airport Marriott, Los Angeles, CA.

(Nov. 8-10)—67th Annual Meeting and 54th Paint Industries' Show. Rivergate, New Orleans, LA.

1990

(Oct. 29-31)—68th Annual Meeting and 55th Paint Industries' Show. Convention Center, Washington, D.C.

SPECIAL SOCIETY MEETINGS

1989

(Feb. 1-3)—Southern Society 16th Annual Water-Borne and Higher-Solids Coatings Symposium. New Orleans, LA. (Dr. Gordon L. Nelson, Chairman, Dept. of Polymer Science, University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Mar. 14-16)—Western Coatings Societies' 19th Biennial Symposium and Show. Disneyland Hotel and Convention Center, Anaheim, CA. (Andrew R. Ellis, NL Chemicals, 231 E. Imperial Highway, Suite 221, Fullerton, CA 92635).

(Apr. 5-7)—Southern Society. Annual Meeting. Hyatt Regency Westshore, Tampa, FL.

(May 4-6)—Pacific Northwest Society. Annual Symposium. Portland Marriott, Portland, OR. (John Daller, McCloskey Corp., 4155 N.W. Yeon, Portland, OR 97210).

OTHER ORGANIZATIONS

1988

(Sept. 18-24)—XIXth Congress of FATIPEC. Aachen, Germany. (C. Bourger, FATIPEC Secretary General, 76 Blvd. Pereire, 75017 Paris, France).

(Sept. 19-22)—Verbundwerk '88 Science and Technology of Composite Materials. Wiesbaden, W. Germany. (Demat Exposition

Managing, 6000 Frankfurt, AM Main, Postbox 110 611, W. Germany).

(Sept. 20-22)—Third Annual Hazardous Waste and Hazardous Materials Management Exhibition and Conference. Convention Center, Cleveland, OH. (Ursula Barril, Northwest Center for Professional Education, 13555 Bel-Red Rd., C-96870, Bellevue, WA 98009).

(Sept. 23)—"Quality Technology for Managers" Seminar sponsored by Du Pont Co. San Francisco, CA. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Oct. 1-4)—Canadian Paint and Coatings Association 1988 Convention. Hotel Newfoundland, St. John's, Newfoundland. (Harold Duffett, The Standard Manufacturing Co. Ltd., P.O. Box 6090, St. John's, Newfoundland, Canada).

(Oct. 3-7)—"17th Introductory—Paint Formulation." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, UMR, Rolla, MO 65401-0249).

(Oct. 4-6)—"Strategy of Experimentation" Seminar sponsored by Du Pont Co. Wilmington, DE. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Oct. 4-7)—12th World Congress on Metal Finishing, INTERFINISH 88. Palais des Congres, Paris, France. (SEPIC INTERFINISH, 17 rue d'Uzes, 75002 Paris, France).

(Oct. 5-7)—Fall Meeting of the National Coil Coaters Association. Westin Hotel, O'Hare Airport, Chicago, IL. (NCCA, 1900 Arch St., Philadelphia, PA 19103).

(Oct. 5-7)—Update '88 Canadian Region—Eastern Conference sponsored by the National Association of Corrosion Engineers. Prince Hotel, Toronto, Ont., Canada. (A. Simcoe, Chairman, Valspar Inc., 645 Coronation Dr., West Hill, Ont., M1E 3R6).

(Oct. 9-12)—17th Annual Conference of the North American Thermal Analysis Society. Lake Buena Vista, FL. (Heidi K. Chen, Akzo Chemie America, 8401 W. 47th St., McCook, IL 60525).

(Oct. 10-13)—15th International Naval Stores Meeting. Intercontinental Ritz and Meridien Hotels, Lisbon, Portugal. (Manco L. Snapp, Jr., Arizona Chemical Co., Panama City, FL).

(Oct. 12-14)—ACS Color Seminar. New Orleans, LA. (Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543).

(Oct. 13-14)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Capri Hotel, Vancouver, B.C., Canada. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Oct. 13-14)—"Fundamentals of Color" Seminar sponsored by Macbeth, a Div. of Kollmorgen, San Jose, CA. (Elaine Tito, Macbeth, Little Britain Rd., P.O. Box 230, Newburgh, NY 12550-0382).

(Oct. 17-18)—"Fundamentals of Color" Seminar sponsored by Macbeth, a Div. of Kollmorgen, Grand Rapids, MI. (Elaine Tito, Macbeth, Little Britain Rd., P.O. Box 230, Newburgh, NY 12550-0382).

(Oct. 17-19)—National Paint & Coatings Association Annual Meeting. Palmer House, Chicago, IL. (NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Oct. 17-19)—National Association of Corrosion Engineers—Tulsa Section. South Central Region Conference. Sheraton-Kensington Hotel, Tulsa, OK. (Conference Chairman Terry May, Mesa Corrosion Control, Inc., P.O. Box 52608, Tulsa, OK 74152).

(Oct. 18-20)—Fall National Plant Engineering and Maintenance Show and Conference. Georgia World Congress Center, Atlanta, GA. (Conference Director, National Plant Engineering and Maintenance Conference, 999 Summer St., P.O. Box 3833, Stamford, CT 06905).

(Oct. 24-26)—"Environmental Control and Emission Monitoring in the Coatings and Polymer Industries" Short Course sponsored by

Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State University, Kent, OH 44242).

(Oct. 25-26)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Sheraton Airport Hotel, Minneapolis, MN. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Oct. 25-27)—"Strategy of Formulations Development" Seminar sponsored by Du Pont Co. Wilmington, DE. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Oct. 26-28)—"Principles in the Stabilization and Controlled Degradation of Polymers," "Principles of High Performance Composites," and "Fundamentals of Adhesion: Theory, Practice and Applications" Short Courses sponsored by the State University of New York. Hotel Thayer, West Point, NY. (Angelos V. Patsis, Chairman, Dept. of Chemistry, DSB 209, State University of New York, New Paltz, NY 12561).

(Oct. 31-Nov. 4)—"Introduction to Polymer Chemistry." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, UMR, Rolla, MO 65401-0249).

(Nov. 1-2)—"Paint Volatile Organic Compounds (VOC)." Two-day Workshop sponsored by ASTM. Hyatt Cherry Hill, Cherry Hill, NJ. (Margaret Cassidy, ASTM, 1916 Race St., Philadelphia, PA 19103).

(Nov. 1-3)—"Maintenance/Industrial Painting Practices" Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Nov. 2-3)—"Painting Processes: Industrial Paint Application Technology." Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(Nov. 4-6)—41st Annual Show and Convention of National Decorating Products Association. McCormick Place, Chicago, IL. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

(Nov. 7-9)—Paint Research Association. Eighth International Conference. Amsterdam, The Netherlands. (Mr. Dip Dasgupta, Head of Information Dept., Paint RA, Waldegrave Rd., Teddington, Middlesex TW11 8LD England).

(Nov. 7-11)—Seventh International Congress on Marine Corrosion and Fouling. Universidad Politécnica de Valencia, Valencia, Spain. [Cátedra de Construcción III, Departamento de Construcciones Arquitectónicas, Universidad Politécnica de Valencia, Camino de Vera, s/n, 46022 Valencia (Spain).]

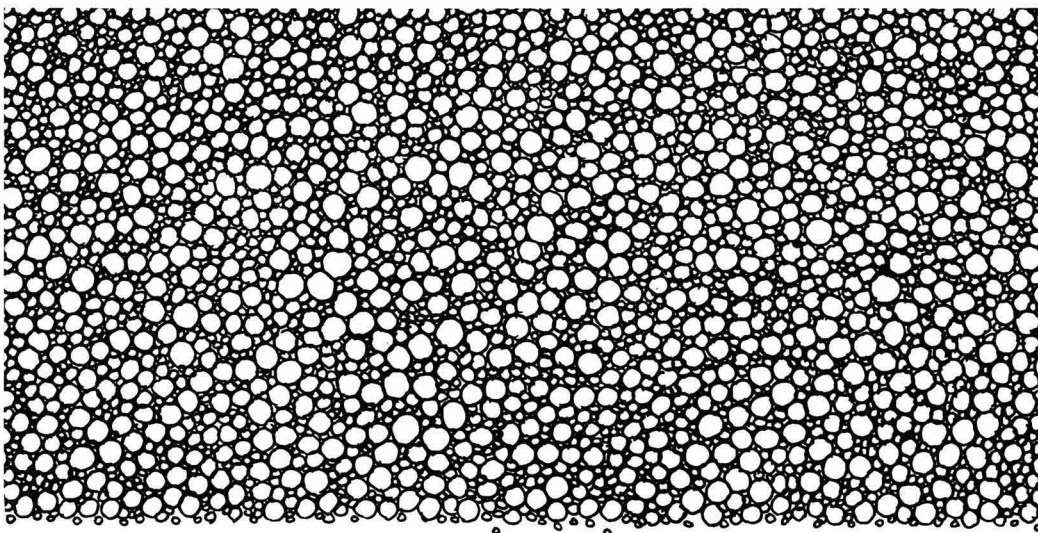
(Nov. 8-9)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Holiday Inn Metro Airport, Detroit, MI. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Nov. 8-10)—"Process Safety Management" Seminar sponsored by Du Pont Co., Wilmington, DE. (Du Pont Safety Services, Barley Mill Plaza, P19-1104, Wilmington, DE, 19898).

(Nov. 8-10)—"Focus on Data" Seminar sponsored by Du Pont Co. Chicago, IL. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Nov. 8-11)—"What European Industry Is Doing" International Symposium on Corrosion Prevention in the Process Industries. Sponsored by the National Association of Corrosion Engineers. Amsterdam Hilton Hotel, Amsterdam, The Netherlands. (NACE Career Development Div., P.O. Box 218340, Houston, TX 77218).

(Nov. 10-13)—10th Annual American Indian Science and Engineering Society Conference. Grand Kempinski Hotel, Dallas, TX. (Karon Johnson, AISES, 1085—14th St., Ste. 1506A, Boulder, CO 80302-7309).



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(Nov. 13-17)—Steel Structures Painting Council. National Conference and Exposition. Civic Center, Baltimore MD. (SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213).

(Nov. 14-15)—“Fundamentals of Color” Seminar sponsored by Macbeth, a Div. of Kollmorgen, King of Prussia, PA. (Elaine Tito, Macbeth, Little Britain Rd., P.O. Box 230, Newburgh, NY 12550-0382).

(Nov. 14-16)—“Quality Control in the Coatings and Polymer Industries.” Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(Nov. 28-Dec. 1)—“Introduction to Coatings Technology.” Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(Nov. 28-Dec. 3)—Materials Research Society Fall Meeting, Symposia, and Exhibition. Boston, MA (MRS, 9800 McKnight Rd., Ste. 327, Pittsburgh, PA 15237).

(Nov. 29-30)—ACS Color Seminar. Greenville, SC. (Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543).

(Nov. 29-Dec. 1)—“Inspection of High Performance Coatings” Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Dec. 3-9)—Chemtech China '88. China International Exhibition Centre, Beijing, China. (SHK International Services Ltd., 22/F., 151 Gloucester Rd., Hong Kong).

(Dec. 5-9)—“Fundamentals of Chromatographic Analysis.” Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(Dec. 12-14)—Winter National Plant Engineering and Maintenance Show and Conference. Anaheim Convention Center, Anaheim, CA. (Conference Director, National Plant Engineering and Maintenance Conference, 999 Summer St., P.O. Box 3833, Stamford, CT 06905).

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(Jan. 24-26)—“Bridge/Highway Structures Coatings Inspection” Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Feb. 1-5)—International Symposium on Industrial Metal Finishing. Karaikudi, India. (Central Electrochemical Research Institute, Karaikudi-623 006, Tamil Nadu, India).

(Feb. 19-22)—“Principles of Adhesion” Short Course and 12th Annual Meeting of The Adhesion Society. Marriott Hotel, Hilton Head Island, SC. (Don Hunston, National Bureau of Standards, Polymers Div., Gaithersburg, MD 20899).

(Feb. 28-Mar. 2)—“Level II—Industrial Maintenance Course” sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Mar. 13-17)—Color '89. Sixth Congress of the International Color Association (AIC). Centro Cultural San Martin, Buenos Aires, Argentina. (Color '89, Grupo Argentino del Color, c/o División Optica, Inti, C.C. 157, 1650 San Martin (BA), Argentina).

(Mar. 14-16)—“Inspection of High Performance Coatings” Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Apr. 8-9)—Eastern Decorating Products Show sponsored by the National Decorating Products Association. World Trade Center, Boston, MA. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

(Apr. 11-14)—“Advances in Corrosion Protection by Organic Coatings” Symposium. Christ's College Cambridge, England. (David Scantlebury, Corrosion and Protection Centre, UMIST, P.O. Box 88, Manchester, U.K. or Martin W. Kenig, Rockwell International Science Center, Thousand Oaks, CA 91360).

(Apr. 23-28)—“7th International Meeting on Radiation Processing.” Noordwijkerhout, The Netherlands. (E. Franken, 7th International Meeting on Radiation Processing, P.O. Box 4240, 6710 EE Ede, The Netherlands).

(Apr. 24-28)—"Applied Rheology for Industrial Chemists." Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(May 1-4)—Society of Manufacturing Engineers' International Conference. Cobo Hall, Detroit, MI. (Violet Greco, SME, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930).

(May 8-12)—"Dispersion of Pigments and Resins in Fluid Media." Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(May 22-26)—"Adhesion Principles and Practice for Coatings and Polymer Scientists." Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(June 21-23)—Oil and Colour Chemists' Association Biennial Conference. Grosvenor Hotel, Chester, England. (Mr. Christopher Lacey-Day, Director, OCCA, Priory House, 967 Harrow Rd., Wembly, Middlesex HA0 2SF, England).

(June 21-23)—"Surface Modification and the Phenomena Resulting from Such Treatments." Conference cosponsored by Dow Corning Corp. and Colorado State University. Holiday Inn, Midland, MI. (W.T. Collins, Dow Corning Corp., Mail Stop C41C00, Midland, MI 48686-0994).

(Aug. 3-6)—31st Annual Convention of the Oil and Colour Chemists' Association Australia. Fairmont Resort, Leura, New South Wales. (Peter Parsons, Tioxide Australia P/L, 2A/6 Tooronga Terrace, Beverly Hills, NSW, Australia 2209).

(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. 26-28)—"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)—Liquitex Expo '89 (Carolyn Mesce, Liquitex Expo, P.O. Box 630, West Paterson, NJ 07424).

(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 0AJ, 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. 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. 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).

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'Humbug' from Hillman

I hope that friend Howard Jerome doesn't feel that he's been neglected and ignored since his contribution, mailed in February, has not appeared in the column until this date. The truth is that I could not get up the nerve to foist it on our unsuspecting audience. However, as this is being written (July 8th), the temperature at the Nest is 90° and my resistance is very low. Howard says he saved the piece from an ancient issue of *C&E News* in "Newscrips" and can't believe that he kept it for all those years. Neither can I.

—"It appears that the Knights of the Round Table included at least one female, Sis Pamela, whom King Arthur dispatched one day to the neighborhood of Casablanca to extricate a comrade who was trapped in a dead-end defile by a dragon who couldn't get in, but wouldn't let the comrade get out. Who this dodo was is not entirely clear, but let's say it was Galahad, bumbling about after the Grail. At any rate, Sis Pamela arrived on the scene after an arduous journey and set upon the dragon at once. The beast was soon prostrate and Galahad emerged from his defile and mounted behind Pamela, who turned her steed's head homeward. They hadn't gone far, however, before Galahad heard a commotion in his rear, looked back, and saw that the dragon had revived and was bearing down on them with slaving jaws. "The dragon's up—it's almost upon us!" he shouted. "Slay it again, Pam."

In my weakened condition, I figured I'd use the above as a leadoff for this month's column. After that, everything will seem outrageously funny.

Since what follows came from the *Erie Pa. Times*, I'll have to blame it on Earl Hill. Anyhow, these are quoted from "A Dictionary of Legal Quotations" (MacMillan):

—Bigamy is having one husband too many. Monogamy is the same.

—Erica Jong

—The poor and ignorant will continue to lie and steal as long as the rich and educated show them how.

—Elbert Hubbard

—Old thieves never die. They just steal away.

—Anon.

—There are only about 20 murders a year in London and not all are serious—some are just husbands killing their wives.

—Comm. G.H. Hatherhill, Scotland Yard

—After all, there couldn't be any blackmail if there wasn't something black going on.

—A.P. Herbert

—A verbal contract is worth the paper it's written on.

—Sam Goldwyn

—There can be no taxation without misrepresentation.

—J.B. Handelsman

—Detectives usually worked in pairs; for obvious reasons, it was physically safer when making an arrest, and also two detectives swearing to the same lies always carried more weight.

—G.F. Newman

—"Give your evidence," said the king, "and don't be nervous or I'll have you executed on the spot."

—Alice's Adventures in Wonderland

And now to the serious business of the challenge between Genius Robert Ahlf, sponsored by unwitting Dr. Tom Miranda and Dr. Peter A. Lewis, sponsored by Dr. Peter A. Lewis. This is truly a heavyweight contest that will be wild to the welcome end.

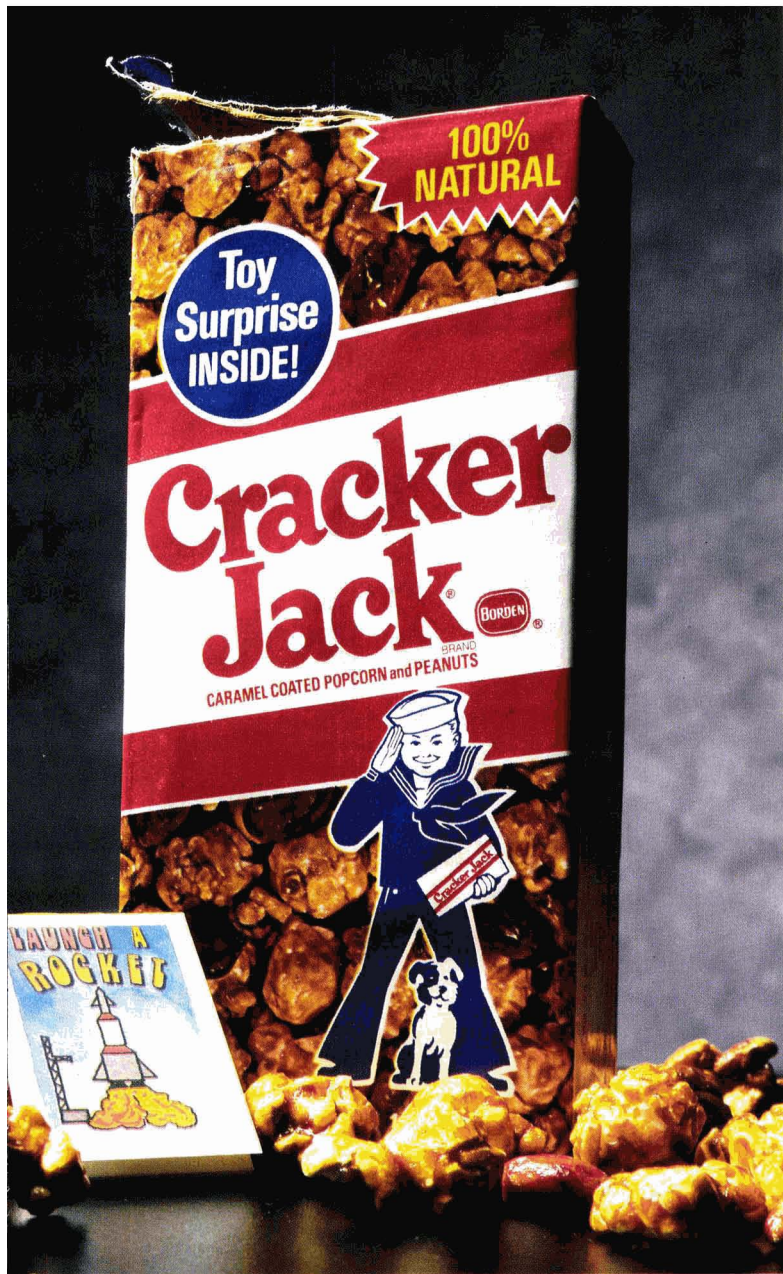
- PAL—I may not be efficient, but I'm cute.
- RA—Don't send me in with instructions to bunt for extra bases.
- PAL—Stop clouding the issues with facts. What we want is alibis.
- RA—My date circled the chair three times before she sat down.
- PAL—Have respect for age, especially if it's bottled.
- RA—I'm satisfied to be below average in SOME things.
- PAL—It's hard to find the reins when you put the cart before the horse.
- RA—When the boss gets his hands on the ball, he changes the game from soccer to football.
- PAL—The secrecy of my job does not permit me to know what I'm doing.
- RA—No wonder it says confidential on my paycheck.
- PAL—Always be sincere, even if you don't mean it.
- RA—You don't know the majority opinion until the Major speaks.
- PAL—PAL Auto Repair Service—try us once, you'll never go anywhere again.
- RA—The farther from the factory floor, the farther from reality.

Contest called temporarily due to audience exhaustion.

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—The Lion

—Herb Hillman
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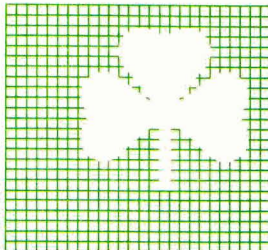
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