JOURNAL OF COATINGS TECHNOLOGY

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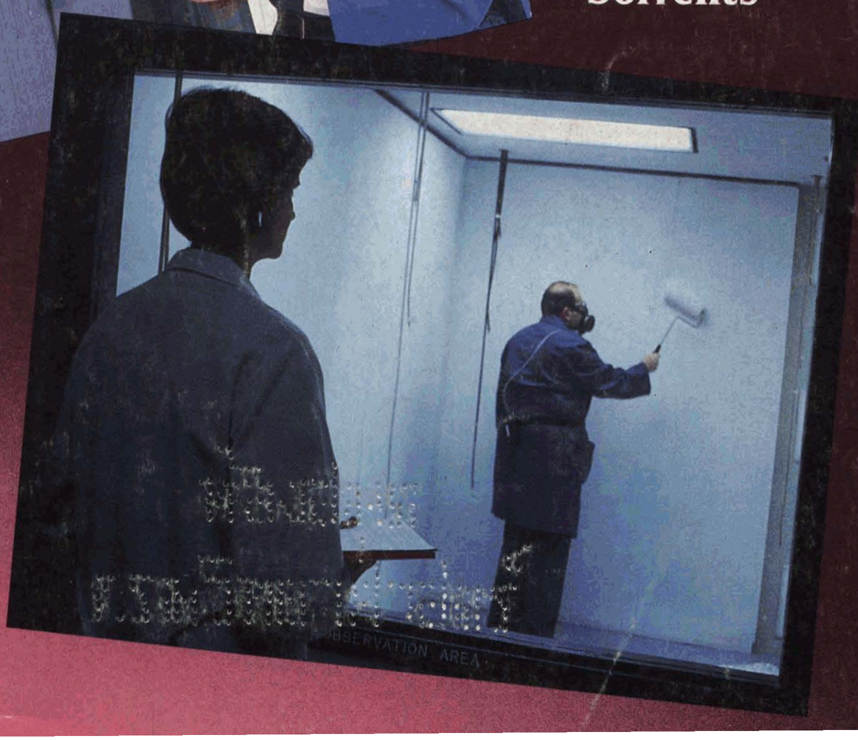
April 1987



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jct JOURNAL OF COATINGS TECHNOLOGY

VOLUME 59 NUMBER 747

Technical Articles

21 Test Facilities for Exposure Assessment of Volatile Organic Solvents—R.L. Smith, et al.

29 Poly-2-Oxazolidone-Urethane Coatings—H. Sehovic, et al.

37 ^{13}C NMR Determination of Lactic Acid Concentration in Cathodically Electrodeposited Coatings—S.B.A. Qaderi, et al.

41 Applications of Computer Data Base Management in Polymer and Coatings Research—M.E. Koehler, A.F. Kah, and T.F. Niemann

Open Forum

45 Quality Assurance in the U.K. Paint Industry: A Review and a Look at the Future—D.W.N. Clayton

Federation News

14 Over 95% of Exhibit Space Reserved for 1987 Federation Paint Industries' Show

Departments

Comment 7 Improving the Coatings/Wood Products Dialogue

Abstracts 10

Government and Industry 18 Seven Trade Associations Petition U.S. Supreme Court

Society Meetings 49

Future Society Meetings 56

Elections 57

People 59

Obituary 60

Meetings/Education 61 Philadelphia Society Schedules "Resins" Seminar

Literature 62

Book Review 65 "Polymeric Materials for Corrosion Control"

CrossLinks 66 Solve Earl Hill's April Challenge

Coming Events 67

Humbug from Hillman 70 Owen Carpenter's Crazy "Bifurcator"

SOCIETY OF NATIONAL ASSOCIATION PUBLICATIONS

BPA

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.

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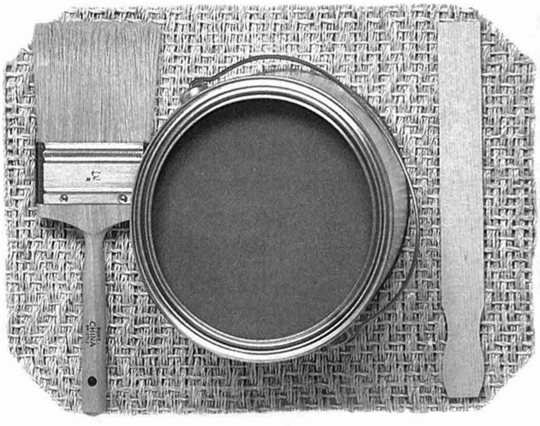

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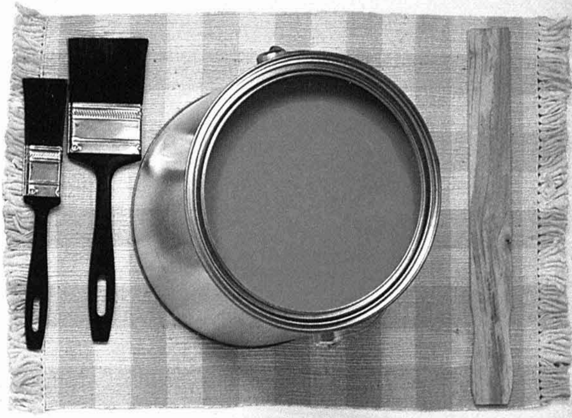

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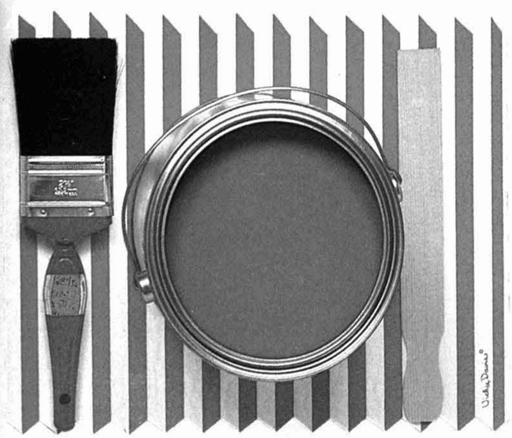

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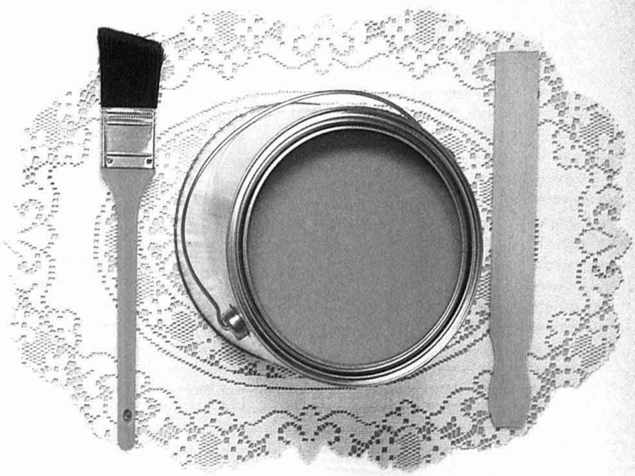

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THE JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology at 1315 Walnut St., Philadelphia, PA 19107. Phone: (215) 545-1507.

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The JOURNAL OF COATINGS TECHNOLOGY has first rights to the publication of papers presented at the Annual Meeting of the Federation and at local and regional meetings of the Federation's Constituent Societies.

A Guide for Authors is published in each January issue.

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.

Comment

Improving the Coatings/Wood Products Dialogue

To say that a sizeable volume of our industry's annual production is destined for the coating of wood and wood products would be an understatement indeed. So, too, would be the observation that wood presents special challenges to the coatings formulator.

It follows, then, that there ought to be a mechanism for maintaining close and ongoing formal liaison between representatives of the coatings and wood products industries. Happily, this has come to pass with the formation of a joint committee, made up of representatives from the Federation and the National Forest Products Association.

Major objectives of the Joint Coatings/Forest Products Committee are: to assess technology relating to new wood, coatings, and construction methods to optimize performance of coated wood; identify technical needs and stimulate research to overcome performance problems; develop practical construction, application and maintenance information to assure maximum satisfaction with the wood/paint (stain) system; and recommend research studies to be carried out by the U.S. Forest Products Laboratories.

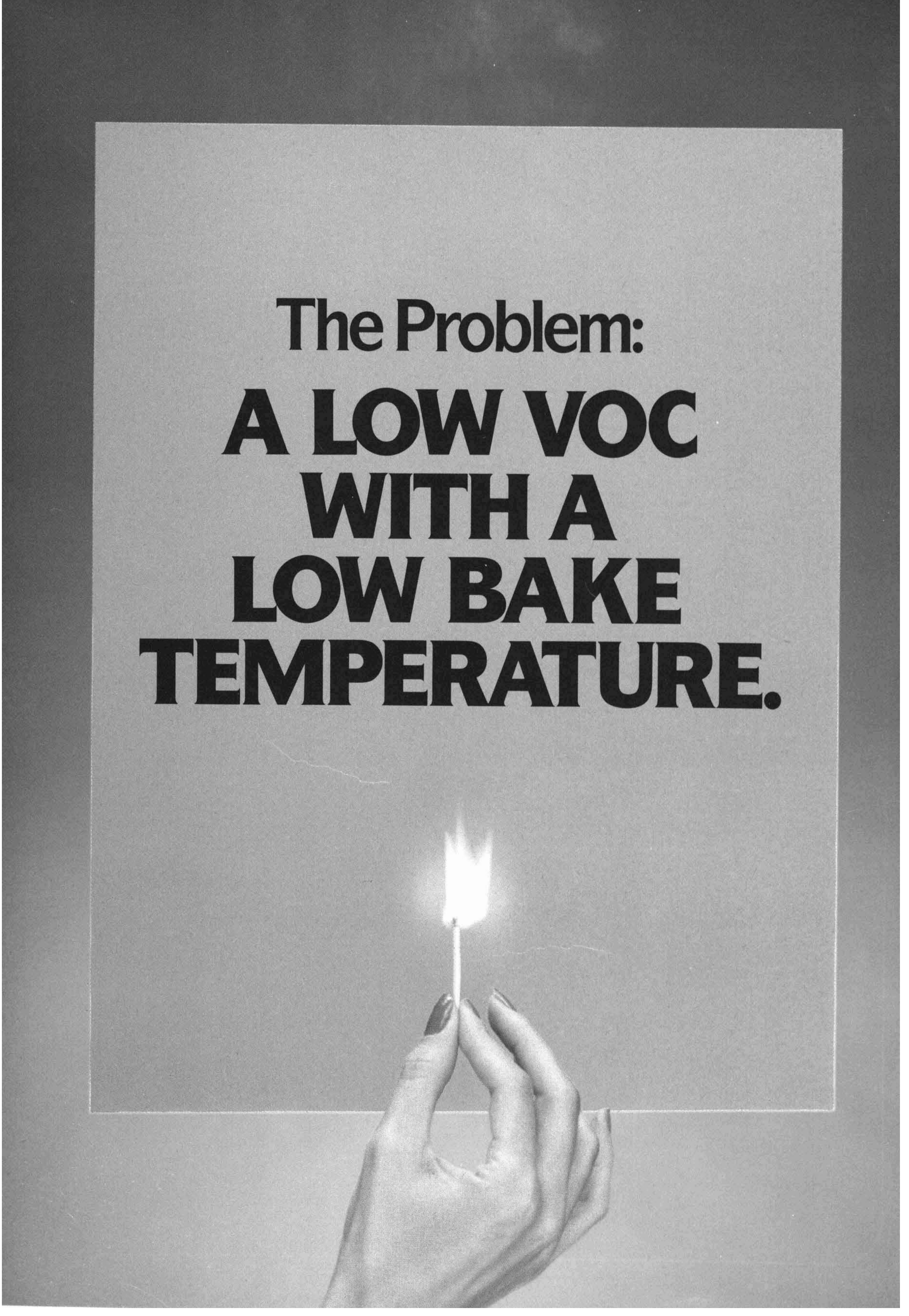
Simply put, the two groups will meet regularly to discuss mutual problems, educate each other concerning products of the respective industries, promote research, and generally improve communications.

An early by-product of this liaison is the seminar on "Coatings for Wood Substrates," to be held in Seattle, May 1-2, under the auspices of the Federation and the Pacific Northwest Society.

Several NFPA members are featured on the program, and it is expected that the forest products industry will be well represented at the event, which offers the unique opportunity to learn potential solutions to specific problems, from the perspective of both coatings manufacturers and wood products suppliers.

It is hoped that the Joint Committee efforts will lead to a meaningful dialogue between coatings and wood products personnel—to accentuate a positive approach, rather than pursuing exercises in finger pointing, when problems develop. For, in the eyes of the consumer, a finish-wood combination is considered to be one, and both must perform or both are indicted.

Thomas A. Kocis,
Contributing Editor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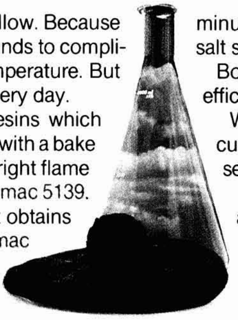

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Abstracts of Papers in This Issue

TEST FACILITIES FOR EXPOSURE ASSESSMENT OF VOLATILE ORGANIC SOLVENTS—R.L. Smith, L.J. Culver, and S.L. Hillman

Journal of Coatings Technology, 59, No. 747, 21 (Apr. 1987)

The effects of exposure to volatile organic solvents is of great interest to the coatings industry, to government regulatory agencies, and to the general public. Many toxicological studies have been conducted or are in progress to determine the relative toxicity of solvents. However, more information is needed to determine the typical exposure levels generated by solvents contained in end-use products. Both toxicity and solvent exposure data should be considered when assessing any hazards associated with a solvent.

This paper describes both test facilities and methods designed to monitor exposure levels in simulated end-use (domestic, office) environments. Variables relevant to exposure testing can be classified into three major categories: product systems, environmental conditions, and application methods. Solvent exposure levels can be monitored during the product application periods and also during the decay periods to define the rate of dissipation from the enclosed area. The computer assisted analysis of the data collected from a sampling matrix of charcoal filled adsorption tubes provides: (1) the average solvent concentration(s) in the test area, (2) the average solvent concentration(s) in the worker's breathing zone, (3) solvent concentration decay rates, and (4) information on the presence of concentration gradients. Data generated from this test facility should be useful in establishing guidelines for handling volatile organic solvents in industrial and/or residential environments.

POLY-2-OXAZOLIDONE-URETHANE COATINGS—H. Sehovic, et al.

Journal of Coatings Technology, 59, No. 747, 29 (Apr. 1987)

2-Oxazolidone-containing polyurethane coatings were synthesized by the reaction of prepolymers based on poly-(oxytetramethylene) glycol (MW 650 and 1000) and four different diisocyanates (MDI, HMDI, H_{12}MDI, and TDI) at various NCO/OH ratios with the diglycidyl ether of bisphenol A (DER 332) catalyzed with LiCl, and the complex compound of LiCl/HMPA in dimethylformamide at 140°C. The procedure of slowly adding the mixture of NCO-terminated prepolymer and epoxide into the catalyst solution at 140°C produced high yields of substituted 2-oxazolidones. The effects of the structure of the diisocyanates and the molecular weight of the polyether polyols on the resulting poly(2-oxazolidone urethane) films were evaluated. These films had excellent flexibility, mechanical properties, and thermal stability.

1987 Schedule of Special Paint Show Issues

1987 Paint Industries Show • Dallas Convention Center • October 5, 6, 7

AUGUST—Featured are the Preliminary Program of Technical Sessions, floor plan of show exhibitors, registration forms, housing forms and hotel information, as well as general show information.

SEPTEMBER—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.

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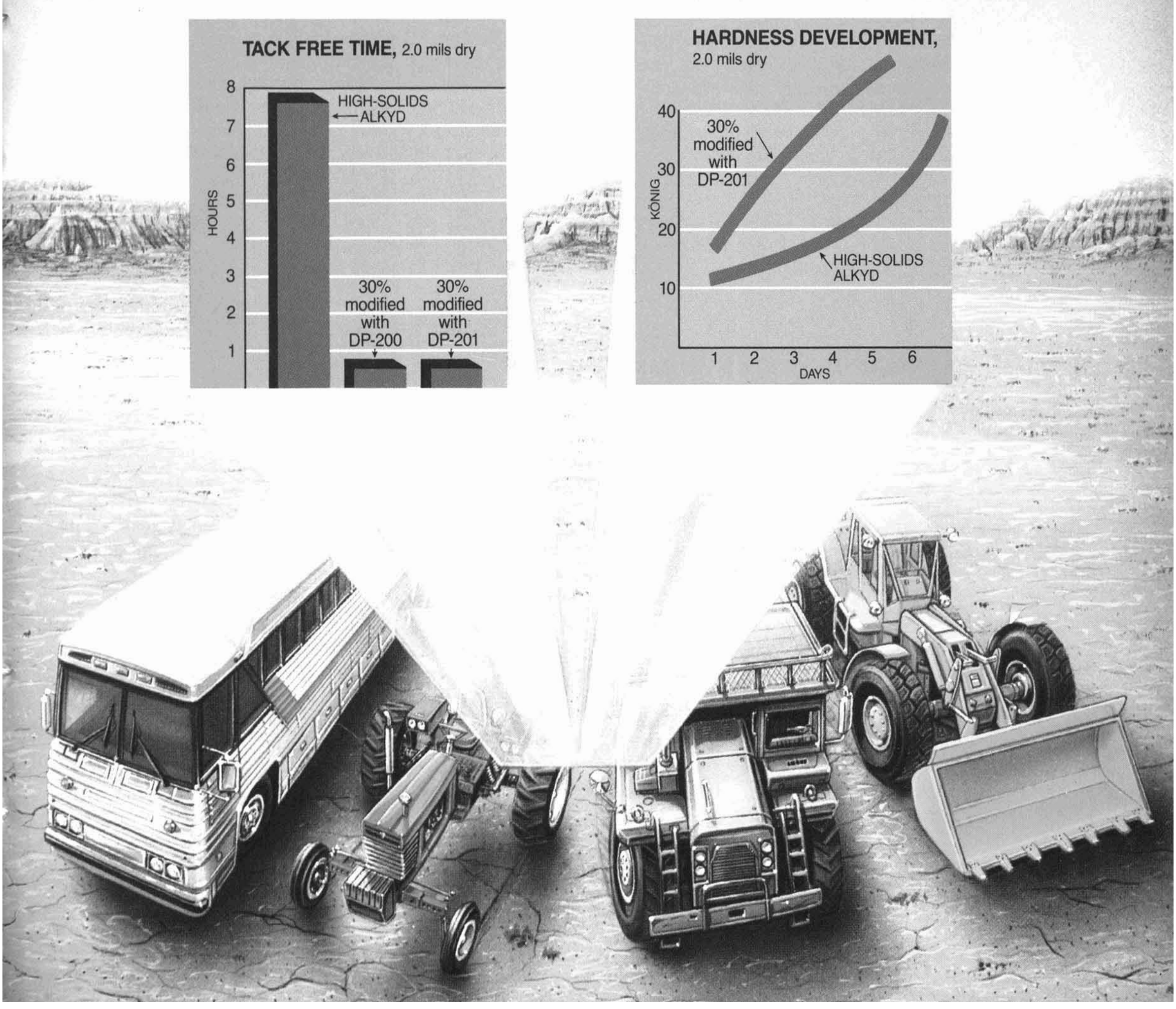

Abstracts of Papers in This Issue *(continued)*

^{13}C NMR DETERMINATION OF LACTIC ACID CONCENTRATION IN CATHODICALLY ELECTRODEPOSITED COATINGS—S.B.A Qaderi, K.R. Carduner, and D.R. Bauer

Journal of Coatings Technology, 59, No. 747, 37 (Apr. 1987)

The level of lactic acid in films formed by cathodic electrodeposition on steel has been determined as a function of the ratio of acid to amine (percent neutralization) in the electrocoat bath and as a function of deposition conditions. Using ^{13}C NMR together with ^{13}C enriched lactic acid, it is shown that the level of lactic acid in deposited films is less than 0.01 wt %, a reduction of 99.9% from the coating bath. This result is independent of percent neutralization and deposition voltage and time. The level of acid retained during cathodic deposition is much less than the level of amine retained during anodic deposition.

APPLICATIONS OF COMPUTER DATA BASE MANAGEMENT IN POLYMER AND COATINGS RESEARCH—M.E. Koehler, A.F. Kah, and T.F. Niemann

Journal of Coatings Technology, 59, No. 747, 41 (Apr. 1987)

The recently acquired ability of the scientist to have easy access to uncomplicated computerized data base management utilities without the necessity of, and the constraints connected with, involving systems personnel in these projects has provided the opportunity to store, retrieve, and analyze data in ways which would not have been practical or even possible before. The data base applications range from very large, complex systems which may have a life of many years, to fairly small, short-term, personal data bases. This paper attempts to describe a range of applications of data base management implemented in our laboratories. These applications include managerial applications such as project monitoring and patent disclosure tracking; information retrieval applications such as a research report index, lab notebook tracking, and file indexing; and technical data retrieval and analysis applications involving exposure test data and laboratory experimental data.

QUALITY ASSURANCE IN THE U.K. PAINT INDUSTRY: A REVIEW AND A LOOK AT THE FUTURE—D.W.N. Clayton

Journal of Coatings Technology, 59, No. 747, 45 (Apr. 1987)

Following the re-awakening to quality awareness in the U.K. and the implications of British Standard 5750 (Quality Systems), the maintenance of a quality system in a major British paint manufacturer is described and the opportunities surveyed.

Over 95% of Exhibit Space Reserved in Dallas For Record-Setting 1987 FSCT Paint Show

The largest Paint Industries' Show of the Federation of Societies for Coatings Technology will be held at the Dallas Convention Center from October 5-7, and will feature hundreds of exhibitor displays devoted to the products and services of the suppliers to the coatings industry. The purpose of the Show is to enable registrants to learn of the latest developments in these products and services and to provide the opportunity to discuss them with the top technical/sales personnel of the exhibitor firms. Currently, over 95% of available exhibit space has been reserved. More than 200 exhibitors, utilizing over 63,000 net square feet of space, will be in the Show. Over 6500 industry personnel are expected to attend. Exhibit hours will be 11:00 to 5:30 on Monday, October 5; 9:00 to 5:30 on Tuesday, October 6; and 9:00 to 3:00 on Wednesday, October 7.

Technical Program

The 64th Annual Meeting of the Federation will be held in conjunction with the Paint Industries' Show. The theme of the meeting, "People and Technology: Cornerstones of Progress," will focus on the coatings industry's most valuable resource—people! They provide the creativity and innovation necessary to meet today's challenges. Program Chairman William A. Wentworth, of Jones-Blair Co., Dallas, TX, and his committee are developing a schedule of presentations which will cover timely issues, including the training of these vital people. Among the sessions being planned are:

- Coating plastics
- Manufacturing
- Corrosion Control
- Matticllo Memorial Lecture
- Roon Awards Competition Papers

Serving on the Program Committee are Richard M. Hille (Vice-Chairman), General Paint & Chemical Co., Cary IL; John C. Ballard, Kurfees Coatings, Inc., Louisville, KY; Gordon P. Bierwagen, Thermark Div. of Avery International, Schererville, IN; Gretchen McKay, Milton Hill Associates, Olympia, WA; John Oates, Troy Chemical Corp., Newark, NJ; A. Gordon Rook, Nuodex Inc., Pleasanton, CA; and Clifford Schoff, PPG Industries, Inc., Allison Park, PA.

Hotels and Reservations

The Federation co-headquarters will be the Hyatt Regency and the Loews Anatole. Other cooperating hotels are: Dallas Hilton, Sheraton Dallas, Adolphus, Plaza of Americas, GreenLeaf, Holiday Inn Downtown, and Dallas Plaza. All housing will be processed by the Dallas Convention and Visitors Bureau, which will accept only the official housing form furnished by the Federation, which will be mailed to all Federation members in April.

Special Air Fares

Delta Air Lines, in cooperation with the FSCT, is offering a special discount fare which affords passengers a 40% maximum savings off Delta's round trip, undiscounted day coach fares for those who travel to the FSCT AM&PS on Delta's domestic system. For travel from Canada, the discount is 30%.

To take advantage of this discount, you must:

(1) Leave for Dallas between October 1 to 6, 1987.

(2) Stay no longer than 15 days.

(3) Purchase tickets at least seven days prior to departure.

(4) Phone 1-800-241-6760 for reservations. Immediately reference the FSCT file number: U0235. The special fares are available only through this number. If you use travel agents, have them place your reservation through the toll-free number to obtain the same fare advantages. Delta also has a variety of other promotion fares, some of which may represent an even greater savings. When you phone for reservations, ask for the best discount applicable to your itinerary.

Spouse's Program

The opening activity for spouses will be the get-acquainted wine & cheese social, Monday afternoon, October 5, in the Dallas Convention Center. On Tuesday, spouses will tour the mansion and the grounds of beautiful Southfork, home of the Ewing family on the popular TV show, "Dallas." Luncheon will be served in the Loews Anatole Hotel. After lunch, there will be a guided tour of many points of interest in the city and nearby suburbs of Dallas. Continental breakfast will be served in both the Hyatt and Loews Anatole on Tuesday and Wednesday.

Board of Directors to Meet

The Federation Board of Directors will meet on Sunday, October 4, in the Loews Anatole.

Host Committee

William F. Holmes, of DeSoto, Inc., Dallas, heads the Host Committee. Assisting him are these subcommittee chairmen: *Spouses*—Mrs. William F. (Jean) Holmes; *Federation Exhibit*—John F. Rothermel, of Sherwin-Williams Co., Garland, TX; *Information Services*—Noel L. Harrison, of Western Specialty Coatings Co., Grand Prairie, TX; *Program Operations*—T. Leon Everett, of Dan Paint and Coatings Mfg. Co., Dallas; and *Registration Area*—Steve Stephens, of Ribelin Sales, Inc., Garland. The Host Societies are the Dallas and Houston Societies for Coatings Technology.

1987 Membership Directory Available from Federation

The 1987 Annual Membership Directory (Year Book) of the Federation of Societies for Coatings Technology has been published.

Listed in the annual directory are the names, companies, addresses, and telephone numbers of the 7000 Federation members by Society. The publication also provides an alphabetical index of members and includes informative details on FSCT Officers, the Board of Directors, Committee Members, and By-Laws.

The Year Book, included with membership in the Federation, is available to non-members for $20 per copy. To place orders, contact Ms. Meryl Cohen, Federation of Societies for Coatings Technology, 1315 Walnut St., Suite 832, Philadelphia, PA 19107, or call (215) 545-1506.

Exhibitors Signed Up for 1987 Paint Industries' Show

(As of March 3, 1987)

Aceto Corp.
Advanced Coating Technologies, Inc.
Advanced Software Designs
Air Products & Chemicals, Inc.
Alcan Powders & Pigments
C.M. Ambrose Co.
American Cyanamid Co.
American Hoechst Corp.
Applied Color Systems, Inc.
Arco Chemical Co.
Aries Software Corp.
Ashland Chemical Co.
Atlas Electric Devices Co.
AZS Corporation

B.A.G. Corp.
BASF Corp./Chemicals Div.
Berol Chemicals, Inc.
Blackmer Pump/Dover Resources Co.
BP Chemicals Ltd.
Brinkmann Instruments, Inc.
Brockway Standard, Inc.
BTL Specialty Resins Corp.
Buckman Laboratories, Inc.
Burgess Pigment Co.
Byk-Chemie USA

Cabot Corp., Cab-O-Sil Div.
Calgon Corp.
Cargill, Inc.
CasChem, Inc.
Catalyst Resources, Inc.
Chemical & Engineering News
Chicago Boiler Co.
CIBA-GEIGY Corp.
Clawson Tank Co.
Coatings Magazine
Colloids, Inc.
Color Corp. of America
Colores Hispania, S.A.
Columbian Chemicals Co.
Commercial Filters
Continental Fibre Drum Co.
Cook Resins & Additives
Cosan Chemical Corp.
Coulter Electronics, Inc.
Cray Valley Products, Inc.
Crosfield Chemicals, Inc.
CUNO Process Filtration Products
Custom Fibers International
Custom Metalcraft, Inc.

D/L Laboratories
Daniel Products Co.
DataLogiX Formula Systems, Inc.
Day-Glo Color Corp.
Degussa Corp.
Diagraph Corp.
Diamond Shamrock Chemicals Co.
Disti, Inc.
Dominion Colour Co.
Dow Chemical USA
Dow Corning Corp.
Draiswerke, Inc.
Drew Chemical Corp.
DSET Laboratories, Inc.
Du Pont Co., DBE Solvents

E.C.C. America
Eastern Michigan University
Eastman Chemical Products, Inc.
Ebonex Corp.
Eiger Machinery, Inc.
Elektro-Physik, Inc.
Engelhard Corp.
Epworth Manufacturing Co., Inc.
Erichsen Instruments, Inc.
Exxon Corp.

Fawcett Co., Inc.
Fed. Soc. for Ctgs. Tech.
Fillite USA, Inc.
Filter Specialists Inc.
Filterite

GAF Corporation
Georgia Kaolin Co., Inc.
Globe Trading Co.
Gorman-Rupp Co.
W.R. Grace & Co., Davison Chem. Div.
Grefco, Inc.

Haake Buchler Instruments, Inc.
Halox Pigments, Div. of Hammond Lead Products
Harshaw/Filtrol Partnership
Hercules Incorporated
Heubach, Inc.
Hilton-Davis Chemical Co.
Hitox Corp. of America
Hockmeyer Equipment Corp.
Hoover Group Inc.
J.M. Huber Corp.
Hunter Associates Laboratory, Inc.

ICI Americas, Inc.
Ideal Manufacturing & Sales Corp.
Illinois Minerals Co.
Interez, Inc.
Itasco Ind., I.W.I., Inc.
ITT Marlow Pumps

S.C. Johnson & Son, Inc., Johnson Wax

Kenrich Petrochemicals, Inc.
Kent State University
Kinetic Dispersion Corp.
King Industries, Inc.
KTA-Tator, Inc.

Liquid Controls Corp.
The Lubrizol Corp., Diversified Prods. Group

Macbeth Div., Kollmorgen Corp.
Magnesium Elektron, Inc.
Malvern Instruments, Inc.
Malvern Minerals Co.
Manchem, Inc.
Manville, Filtration & Minerals
Marco Scientific, Inc.
The McCloskey Corp.
McWhorter, Inc.
The Mearl Corp.
Mettler Instrument Corp.
Micro Powders, Inc.
Micromeritics Instrument Corp.
Miller Paint Equipment, Inc.
Milton Roy Co.
Mineral Pigments Corp.
MiniFIBERS, Inc.
Minolta Corp.
University of Missouri-Rolla
Mixing Equipment Co.
Mobay Corp.
Modern Paint & Coatings
Morehouse Industries, Inc.
Mozel Incorporated
Myers Engineering

National Assoc. of Corrosion Engineers
Netzsch Incorporated
Neupak, Inc.
Neville Chemical Co.
NL Chemicals, Inc.
North Dakota State University
Novopak Warner, Inc.
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P.A. Industries
Pacific Micro Software Engineering
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Permuthane, Inc.
Pfizer Pigments, Inc.
Phillips 66 Co., Specialty Chems.
Plastican
Poly-Resyn, Inc.

Polyvinyl Chemicals Inc.
PPG Industries, Inc.
Premier Mill Corp.
Progressive Recovery, Inc.

Q-Panel Co.

RAABE Corp.
Red Devil, Inc.
Reichhold Chemicals, Inc.
Research Data Access Corp.
Rheometrics, Inc.
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Unocal Chemicals Div., Unocal Corp.

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Warren Rupp-Houdaille, Inc.
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Special Discount Fares Available from Delta To Annual Meeting

Special arrangements have been made with Delta Airlines to offer discounted fares within the U.S. to/from Dallas, TX, for the October 5-7 Annual Meeting and Paint Industries' Show, at the Dallas Convention Center. These special fares are available only when you call the unlisted toll-free number 1-800-241-6760. Be sure to ask for the lowest fare available. You must give the FSCT Convention number, which is:
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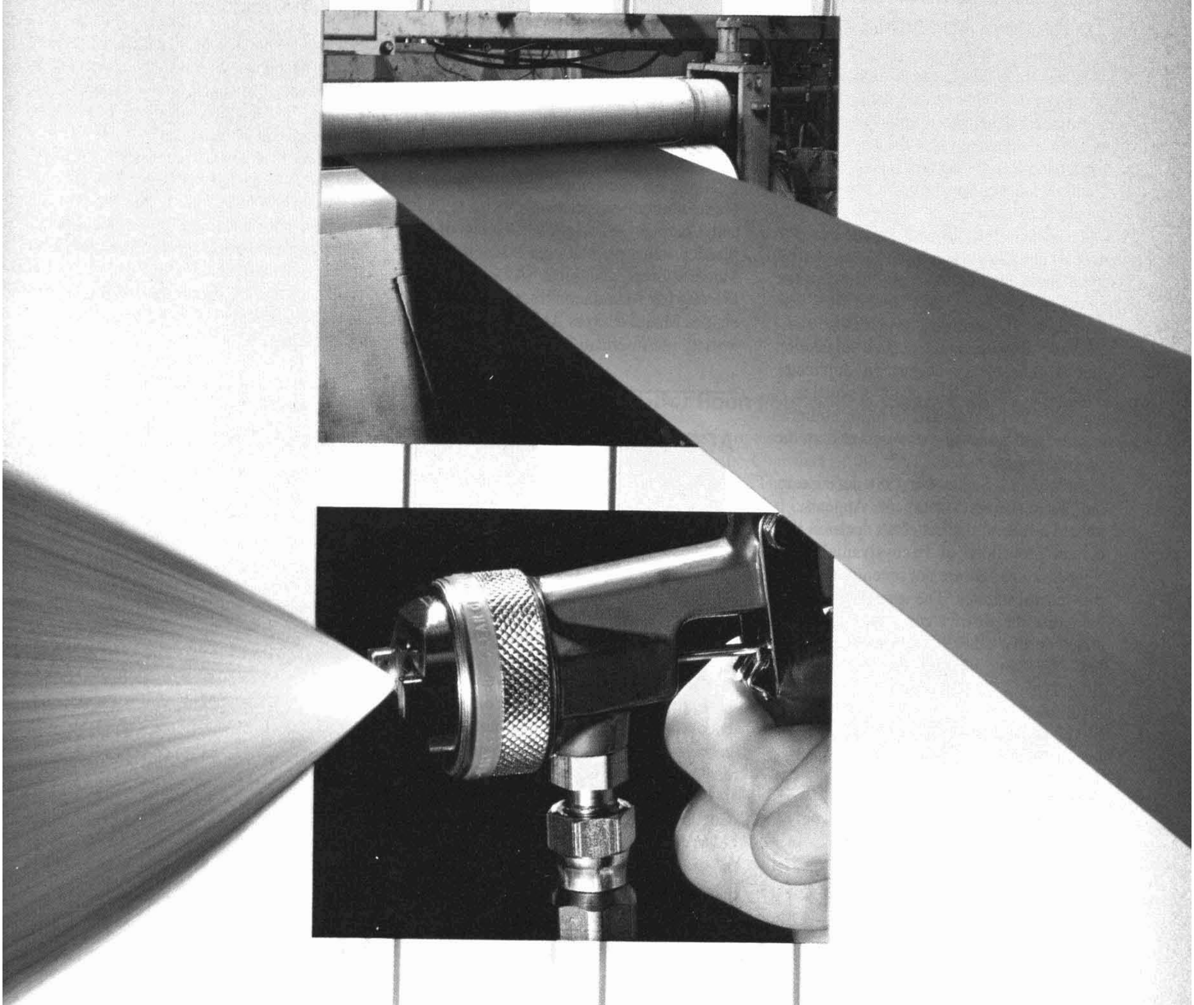
Three new coating resins offer some very good reasons to call Inolex.



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Trade Associations Petition U.S. Supreme Court To Review Appeals Court Ruling on OSHA Standard

Seven trade associations filed a friend-of-the-court brief with the U.S. Supreme Court asking them to review a lower federal court's decision that the Occupational Safety and Health Act and OSHA's Hazard Communication Standard do not preempt similar state laws.

The trade associations maintained the appeals court has "undermined the carefully balanced preemption" provisions of the Occupational Safety and Health Act. The appeals court, according to the trade associations, also encouraged state legislation that is unnecessary because it duplicates the federal statute. The group's position is that the OSHA standard is more comprehensive and protective of workers than the varying state laws.

At issue is a September 1986 decision by the Third Circuit Court of Appeals. It upheld a federal district court decision that certain provisions of Pennsylvania's new right-to-know law are not preempted by the two federal statutes. The appeals court also held that the district court was wrong to conclude that other provisions of the state law—including labeling and material safety data sheets (MSDS) requirements—were preempted.

The associations listed three major problems with the appeals court decision. They are:

(1) It conflicts with the OSH Act and the OSHA Hazard Communication Standard,

(2) The growing number of state right-to-know laws for which OSHA approval has not been obtained demonstrates the importance of the issue, and

(3) The plain language of the OSH Act and decisions of the Supreme Court demand a broad preemption test to counter the proliferation of state hazard communication regulations.

The seven associations are the Chemical Manufacturers Association, National Paint and Coatings Association, Society of the Plastics Industry, National Association of Manufacturers, National Association of Printing Ink Manufacturers, Chemical Specialties Manufacturers Association, and the Society of American Wood Preservers.

E.T. Horn Purchased By Van Ommeren

Van Ommeren, the Rotterdam (Netherlands)-based service group involved in worldwide transportation, storage, and trading, has recently acquired E.T. Horn Company, La Mirada, CA.

The E.T. Horn Co. represents approximately 30 U.S. and foreign chemical companies in the food, paint, pharmaceutical, plastics, adhesives, and electronics industries. Former owners, E.T. Horn and Gene Alley, will continue to manage the company and Patrick Marantette will continue in his function as Executive Vice-President of the firm.

ACS Seeks Nominees for Roy W. Tess Award

The American Chemical Society's Division of Polymeric Materials: Science and Engineering (PMSE) is seeking nominations for the Roy W. Tess Award in coatings. The award will be presented at the 195th meeting of the ACS, September 25-30, 1988, in Los Angeles.

The award, made possible by a generous grant of $1,000 by Dr. Tess, recognizes outstanding individual achievements and noteworthy contributions to coatings science, technology, and engineering, and confirms PSME's longstanding support and dedication to excellence in the coatings field.

George R. Pilcher, of Hanna Chemical Coatings Co., is Chairman of the Tess Award Committee. The members of the nominating committee are: Vice-Chairman Joseph A. Vasta, of DuPont Co.; Otto Vogel, of Polytechnic University; Charles E. Hoyle, of the University of Southern Mississippi; Percy E. Pierce, of PPG Industries, Inc.; and F. Louis Floyd, of Glidden Coatings & Resins.

Nominations, welcome from all sections of industry and academia, should be forwarded to the Chairman at Hanna Chemical Coatings Co., P.O. Box 147, Columbus, OH 43216-0147. Upon receipt of names, the Chairman will submit a documentation form requesting information on the nominee relevant to patents, publications, etc. All nominations for the 1988 Tess Award should be sent prior to September 1, 1988. Nominations received after September 1, 1988, will be considered for the succeeding year's award.

SCM Chemicals Establishes New World Headquarters

The SCM Pigments Div. of SCM Corp. has changed its name to SCM Chemicals, a subsidiary of Hanson Industries and announced the establishment of a new world headquarters in Baltimore, MD.

SCM Chemicals is a producer of titanium dioxide, a white pigment used as an opacifier and a whitener in paint, paper, plastics, and rubber products. The company currently operates seven titanium dioxide plants worldwide. Current plans call for a major expansion of its Bunbury, Australia plant.

Johnson Wax Building New Resin Plant

The Johnson Wax Specialty Chemicals Group, S.C. Johnson & Son, Inc., Racine, WI, has announced the start-up of a new resin production facility at the company's Waxdale production complex in Racine. Johnson Wax has incorporated the latest "state-of-the-art" computer technology, and advanced design production and handling equipment into its operation.

Perry & Derrick Acquires Foy-Johnston Business

The Perry & Derrick Co., Inc., has concluded the acquisition of the trade sales (shelf goods) business of Foy-Johnston, Inc., an independent paint manufacturer. Both companies are based in Cincinnati, OH.

The purchase covers immediate transfer of the Foy-Johnston name, formulae, and trademarks to Perry & Derrick. No changes are expected in these areas and the existing trade sales force is being retained.

The acquisition will provide Perry & Derrick with an increase in raw materials purchasing and paint production, and will increase their total shelf goods production by 25%.

The industrial business of the former Foy-Johnston organization will continue as the Cincinnati Varnish Co. The firm is dedicating its entire Cincinnati and Jasper, IN, facilities to the development and manufacture of industrial finishes.

JOURNAL OF COATINGS TECHNOLOGY

GUIDE FOR AUTHORS

GENERAL

The JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology for its membership of approximately 7,000 in 26 Constituent Societies in the United States, Canada, Great Britain, and Mexico. The JOURNAL is devoted to the advancement of knowledge in the science and technology of surface coatings, the materials comprising such coatings, and their use and performance.

The Editors invite the submission not only of regular research papers, but also *Open Forum* comments on subjects of relevant interest, and *Letters to the Editor.* All manuscripts will be assumed to be original work and to have been unpublished elsewhere; not under consideration for such publication; not copyrighted; and to have been submitted for appropriate clearance by the organization with which the author is affiliated if such clearance is necessary. Authors are obligated to reveal any exceptions to these conditions at the time a manuscript is submitted.

The JOURNAL OF COATINGS TECHNOLOGY has first right to the publication of papers presented at the Annual Meeting of the Federation and at local or regional meetings or symposia of the Constituent Societies. ***Papers in which proprietary products or processes are promoted for commercial purposes are specifically non-acceptable for publication.***

SUBMISSION OF MANUSCRIPTS . . .

. . . for the Journal

Technical Papers: Four complete copies should be sent to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 1315 Walnut St., Philadelphia, PA 19107.

If a submitted paper consists of the text of a presentation made previously to a monthly or special meeting of a Society for Coatings Technology, or to another technical group, the name of the organization and the date of the presentation should be given. If someone other than the author of the paper made the presentation, this information, too, should be noted. Papers presented to associations other than the Federation must be released by written communication before they can be considered for publication in the JOURNAL OF COATINGS TECHNOLOGY.

Papers originally composed for oral presentation may have to be revised or rewritten by the author to conform to the style suitable for written publication.

Open Forum: Three complete copies should be sent to the Open Forum Editor, at the address listed above.

The same general rules as given for technical papers should be followed in the preparation of an Open Forum manuscript. However, the subject may be informally approached. Topics may be nontechnical in nature, dealing with any aspect of the coatings industry.

Letter to the Editor: The JOURNAL will consider for publication all correspondence relevant to the coatings industry and to the contents of the JOURNAL. When a letter concerns an article appearing in the JOURNAL, the original author is usually given an opportunity to reply.

. . . by Constituent Societies For Annual Meeting Presentation

Ten complete copies of the manuscript are required for committee review. The set of copies should be addressed to the Editor at the address listed above.

. . . for Roon Foundation Award Competition

Ten complete copies of the manuscript are required, and should be submitted to the Chairman of the 1987 Roon Awards Committee, Gary Gardner, Tnemec Co., Inc., P.O. Box 1749, Kansas City, MO 64141. (For complete details, see "Roon Awards" section of the JOURNAL for January 1987.)

MANUSCRIPT PREPARATION

In general, authors are advised to use the "Handbook for Authors" published by the American Chemical Society as a guide to the preparation of manuscripts (ACS, 1155 Sixteenth St., Washington, D.C. 20036). Another excellent reference work is "How to Write and Publish a Scientific Paper" by Robert A. Day (ISI Press, 3501 Market St., University City Science Center, Philadelphia, PA 19104).

Manuscripts should be typed with double spacing on one side of 8½ × 11 inch (22 × 28 cm) paper, with at least one-inch (2.5 cm) margins on all four sides. All paragraphs should be indented five spaces, and all pages should be numbered at the top center, or upper right corner.

Title

The title should be as brief and informative as possible. Selection of titles that are key word-indexable is a helpful and recommended practice.

Authors' Biographies and Photographs

Give complete names, company or institutional affiliations, and brief biographical sketches of all authors. If available, submit a 5 × 7 inch (13 × 18 cm) black-and-white photograph with glossy or smooth high sheen surface, for each author. See later section on photographs for further details.

Abstracts

A 75–100 word abstract must be part of the manuscript, and should be a concise description of the key findings or teachings of the work described in the paper. The abstract should not repeat the title or include reference numbers, nor should it duplicate the Conclusion or Summary.

Text

The headings and sub-headings in this Guide illustrate their use to divide the text into sections to improve readability for comprehension, and to break up typographical monotony; they may be used as a model for preparation of the text of a manuscript for publication. The text should *not* be presented as an alphanumeric outline.

Only as much review as is necessary should be given to provide an introduction to the subject; the main burden for extensive background should be placed on the list of references.

Standard scientific and technical terminology should be used to convey clear and unambiguous meaning, but the use of technical jargon or slang should be avoided. Authors should bear in mind that the JOURNAL has an international audience, for many of whom English is a second, not native, language. Use of regional idioms or colloquialisms should be avoided. The use of obscure abbreviations is also discouraged. When appropriate, abbreviations should be made in parenthesis immediately following first mention of the term in the text, and then used alone whenever necessary.

Recent issues of the JOURNAL should be consulted for desired style and technical level.

Metric System

Metric system units should be used wherever applicable with the equivalent English units shown afterwords in parentheses. The ASTM Metric Practice Guide, E 380-72 (American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103) is a convenient reference.

Tables, Graphs, and Drawings

Tables, rather than descriptive text, should be used only when they are genuinely helpful. They should be proportioned in accordance with the height and width limitations of the JOURNAL'S pages. Each table should be typed on a separate sheet, rather than included in the text, and appended to the manuscript. Each table should be numbered and have a descriptive caption. Tables should be referenced in the text (e.g., "See Table 1").

In numerical data in tables, numbers less than one should have a zero before the decimal point.

Graphs should be on good quality white or non-photographic blue-lined $8\frac{1}{2} \times 11$ inch paper. Each graph should be drawn on a separate sheet, numbered, and the captions listed on a *copy* of the original graph. Graph captions and legends should also be typed on a separate sheet for typesetting.

Graphs should not be used if they merely duplicate the data given in tables, or vice versa.

Drawings should conform to the guidelines given for Graphs and should be proportioned to fit the height-to-width ratio of the JOURNAL'S pages and columns.

Photographs

All photographs should be sharp, clear, black-and-white prints no larger than 8×10 inches in size. Photos should be clearly labeled on the reverse side, taking care not to mar the image.

Color prints and slides are unacceptable.

When illustrations are secured from an outside source, the source must be identified and the Editor assured that permission to reprint has been granted.

Nomenclature

Whenever possible, generic names should be used in preference to trade names. When trade names must be used to avoid ambiguity, and the name is a registered trademark, the symbol R, in a circle or parentheses, should be given immediately following, and the manufacturer listed as a footnote. In general, trade names should be used only in footnotes or in an appendix, rather than in the text.

If special nomenclature is used, include a nomenclature table giving definitions and dimensions for all terms.

Nomenclature of chemical compounds should conform to the style of *Chemical Abstracts* and the IUPAC rules.

Equations

These must be typed, or written clearly, with equations numbered sequentially in parentheses to the right. If Greek letters are used, write out their names in the manuscript margin at the first point of use. Place superscripts^{a} and subscripts$_{b}$ accurately. Avoid the use of superscripts in a manner that can lead to their interpretation as exponents.

Summary

The paper should be concluded with a summary which is intelligible without reference to the main text. The summary may be more complete than the abstract, listing conclusions drawn from the text. A well written summary can serve to inspire the busy reader to turn back to the paper, to read it thoroughly.

Acknowledgment

If used, it should follow the summary.

References

These should be listed in the numerical order in which they are cited in the text, and should be placed at the end of the manuscript. Names of authors may or may not be shown in the text with reference numbers. If possible, include titles of articles referenced in the literature. The following are examples of acceptable reference citations for periodicals[1,2,3] and books[4]:

(1) Pascal, R.H. and Reig, F.L., "Pigment Colors and Surfactant Selection," *Official* DIGEST, *36*, No. 475 (Part 1), 839 (1964).

(2) Davidson, H.R., "Use and Misuse of Computers in Color Control, " JOURNAL OF COATINGS TECHNOLOGY, *54*, No. 691, 55 (1982).

(3) Stephen H.G., "Hydrogen Bonding—Key to Dispersion?," *J. Oil & Colour Chemists' Assoc.*, *65*, No. 5, 191 (1982).

(4) Patton, T. (Ed.), "Pigment Handbook," Vol. I, John Wiley & Sons, Inc., New York, 1973.

OTHER INFORMATION

Galley proofs will be sent to the author for checking about six weeks prior to publication.

Offprints may be purchased in quantities of 100 or more. Authors will receive price quotations. Each author will receive a complimentary copy of the JOURNAL issue in which his or her paper was published.

Test Facilities for Exposure Assessment Of Volatile Organic Solvents

Richard L. Smith, Larry J. Culver, and Saundra L. Hillman
Eastman Chemical Products, Incorporated*

The effects of exposure to volatile organic solvents is of great interest to the coatings industry, to government regulatory agencies, and to the general public. Many toxicological studies have been conducted or are in progress to determine the relative toxicity of solvents. However, more information is needed to determine the typical exposure levels generated by solvents contained in end-use products. Both toxicity and solvent exposure data should be considered when assessing any hazards associated with a solvent.

This paper describes both test facilities and methods designed to monitor exposure levels in simulated end-use (domestic, office) environments. Variables relevant to exposure testing can be classified into three major categories: product systems, environmental conditions, and application methods. Solvent exposure levels can be monitored during the product application periods and also during the decay periods to define the rate of dissipation from the enclosed area. The computer assisted analysis of the data collected from a sampling matrix of charcoal filled adsorption tubes provides: (1) the average solvent concentration(s) in the test area, (2) the average solvent concentration(s) in the worker's breathing zone, (3) solvent concentration decay rates, and (4) information on the presence of concentration gradients. Data generated from this test facility should be useful in establishing guidelines for handling volatile organic solvents in industrial and/or residential environments.

INTRODUCTION

In 1984, Eastman Chemicals Division constructed facilities to measure vapor concentration of organic solvents emitted during the use of consumer products in a simulated residential environment. The decision to construct these facilities was arrived at because:

(1) There was only limited information available on the degree of solvent vapor exposure by inhalation resulting during the application of consumer products containing volatile organic compounds.

(2) The potential hazards associated with the use of volatile solvents are of increasing concern to the general public, government agencies, and many segments of industry.

(3) In evaluating the risks associated with the use of a particular product containing volatile solvents, the extent of exposure should be considered in combination with the established toxicity data. Chemical hazard assessment requires both exposure and toxicity data.

(4) In the development of new products for use in the consumer area, projected exposure data on the product are needed.

(5) Experimental vapor concentration data were needed in developing computer programs to predict exposure levels and for comparison with present and future theoretical exposure models.

The goal of this paper is to: (1) describe the test facility, (2) review the methods used to collect, monitor, and analyze the solvent vapor in the simulated end-use environment, (3) describe the computer programs used to capture, store, and process data developed from the stud-

Presented at the 64th Annual Meeting of the Federation of Societies for Coatings Technology, in Atlanta, GA, on November 6, 1986.

*P.O. Box 431, Kingsport, TN 37662.

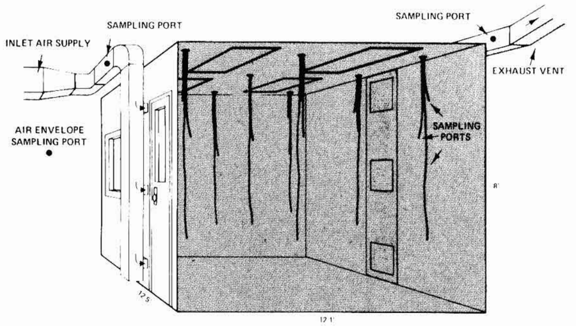


Figure 1—Solvent exposure test facility

ies, and (4) present examples of solvent vapor concentration obtained from the testing of a latex paint and a commercial glass cleaner.

TEST FACILITY

The solvent exposure test facility constructed at Eastman Chemical Products, Inc., in Kingsport, TN, consists of a self-contained (12.5′ × 12.1′ × 8′) room constructed within a larger room (see *Figure* 1) in the Technical Service and Development Laboratories. The test facility is designed to allow monitoring of solvent vapor in a simulated residential environment under conditions where variables are well-defined and controllable.

Variables such as application method (brush, roll, aerosol spray, etc.), environmental conditions (air turnover rate per hour, temperature, etc.), and product composition (window cleaner, latex paint, aerosol paint, etc.) were considered in the planning of the facility. The room dimensions were selected to give the surface area/volume relationship of a typical room in the average size home. A window and glass paneled door were installed in the front

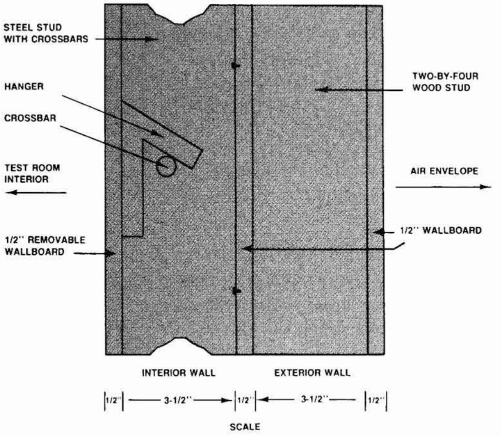


Figure 2—Cross-section of test facility wall

side of the test room so the test operations could be observed from the outside.

The facilities also include a glass surface for use in conducting tests on commercial glass cleaners. The existing concrete floor in the building serves as the floor of the test room. Other flooring surfaces (linoleum, tile) can be installed over the concrete surface for testing products, such as floor polishes and waxes. The walls of the room are constructed with two-by-four studs sandwiched between gypsum wallboard sheets (4′ × 8′ × ½″). A "false" wall is constructed around the inside perimeter of the room by attaching ½″ wallboard sheets to cross bars on metal studs mounted on the permanent interior wall (see *Figure* 2). The design provides a convenient way of replacing contaminated sheets when a succeeding exposure test requires a clean or varied substrate. The room is lighted with recessed fluorescent ceiling fixtures, encased in finished wallboard. Silicone-based sealant and rubber or foam gaskets are used around the door, window, and lighting fixtures to minimize air leakage.

The room is equipped with an adjustable air supply system (see *Figure* 3). The air turnover rate per hour in the room can be adjusted in the range of <1 to 15. The variance in air flow rates allows the simulation of air turnover rates typical in a well insulated home to a well ventilated office area. Air enters the room through three vertically stacked vents on the front wall of the test chamber and exits the room through three vertically stacked vents on the rear wall. Each vent can be opened and closed to obtain numerous air flow patterns. Air is supplied by a large duct connected to the building ventilation system and is exhausted through the building exhaust ducts. The ventilation rate is adjustable to match the environmental conditions being simulated and is regulated by variable speed fans located in the inlet and exhaust ducts and by dampers located in each of the inlet and exhaust vents. Gauges measure the pressure drop across both the inlet and exhaust air vents to ensure that no major pressure differences occur within the room to create negative or positive pressure. For air sampling purposes, a matrix of 27 sampling tubes is located within the test room with entrance ports for the tubes in the ceiling of the room. The physical arrangement of the sampling tubes allows the test data to be examined for non-uniform distribution of the solvent vapors in the room (see *Table* 5).

Sampling tubes are located in the ceiling, breathing zone, and floor planes of the room. Rubber tubing joins each charcoal tube with a flow-limiting orifice that is calibrated for each experiment using a Buck Calibrator Flowmeter. The orifice, corresponding manifolds, vacuum pumps, and electrical controls are all located on the roof of the room (see *Figures* 4 and 5). The sampling entrance ports and ancillary equipment are located in the ceiling and on the roof, so that charcoal tubes can be added or removed with minimal disturbance of the room variables. The design is also useful for experiments when the product being evaluated is applied to the floor of the room and requires an extended drying time. Decay data can be collected by installing additional sets of new charcoal tubes without actually entering the room. Additional sampling tubes monitor the inlet air stream, exhaust air stream, and the air envelope surrounding the test room to ensure that the solvent(s) detected within the room originates only from the product being investigated and not from outside contaminated air sources. Replicate sampling tubes are placed at various locations to establish statistical significance and reproducibility factors. The operator also wears air sampling tubes, badges, and portable vacuum pumps positioned to collect operator breathing zone air samples.

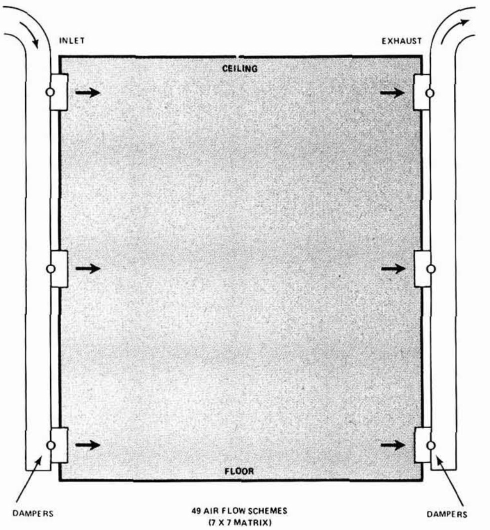


Figure 3—Solvent exposure project room ventilation cross-section air flow diagram

SAMPLING PROCEDURE*

Air sampling is conducted during the product application period and also at various intervals after the application ceases in order to investigate the decay rate of the solvent concentration. Position and number of sample tubes and badges is based on statistical design considerations. Air samples are collected using charcoal-filled adsorption tubes (see *Figure* 6). A known volume of air is drawn through the tubes where the solvent vapors are adsorbed on the activated charcoal. To monitor the breathing zone of the operator applying the product during the exposure test, the operator wears a lapel-mounted, charcoal sampling tube(s) attached to a battery-operated sampling pump. For comparison purposes, the operator also wears a diffusional badge.

During each experiment, the operator uses a breathing apparatus consisting of an organic vapor chemical cartridge respirator with a facepiece which fits over the nose

*See Appendix for a list of sample collection and analysis equipment.

Table 1—Electronic Spreadsheet Example for Entering Raw Data

A B C D E F G H I J K L M N O P Q

Solvent Name	Industrial Hygiene Code	Sample Location	CCode Solvent Mass µg	PPM Factor HCode Air Flow Rate mL/Min	Start Time Min	End Time Min	Test Run No.	Test Facility	Date Experiment	Monitor Time	Volume Air	PPM Solvent Code	PPM Factor
		1											
		2											
		3											
		4											
		5											
		45											
		46											
		47											
		48											
		49											

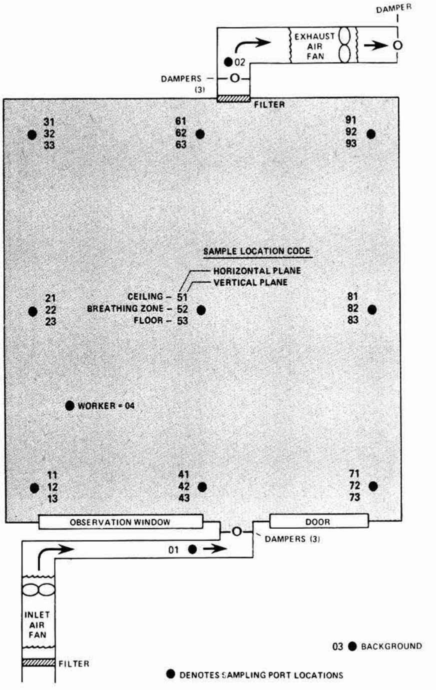


Figure 4—Solvent exposure project air sampling matrix diagram

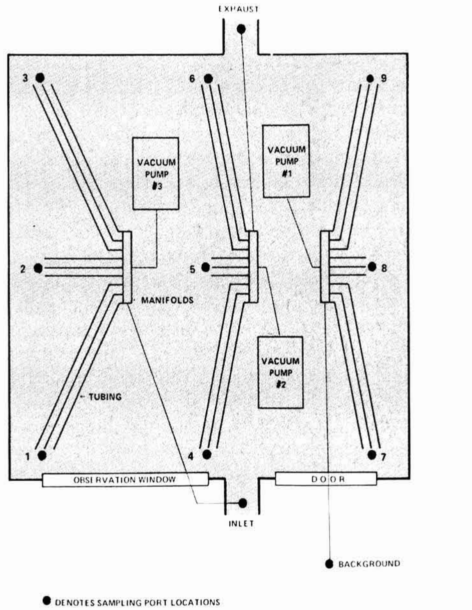


Figure 5—Air sampling manifold located on the roof of test room

and under the chin. The chemical cartridges are replaced as needed depending on hours of service, solvent vapor type, and concentration.

SAMPLE ANALYSIS

Analysis of solvents contained on each charcoal tube is conducted using a method similar to those published by the National Institute for Occupational Safety and Health.* After the specified monitoring period, the tubes are collected, immediately capped, and transferred to the Eastman Industrial Hygiene Analytical Laboratory for analysis. The adsorbed solvents are desorbed from the charcoal using carbon disulfide. The solvent solutions are then quantitated by gas chromatography and the values entered into an electronic spreadsheet (ESS) (*Table* 1) where the parts per million solvent present in the air are calculated using the following formula:

$$PPM = \left[\frac{\mu g}{L} \times \frac{22.45}{MW} \times \frac{760}{P} \times \frac{(T+273)}{273} \right] \div DE$$

Where:

μg = micrograms solvent from charcoal analysis
L = volume of air sampled in litres
MW = Molecular weight of solvent in grams
22.45 = molar volume (litre/mole) at 0°C and 760mmHg
P = Pressure (mmHg) of air
T = Temperature (°C) of air
DE = Desorption efficiency.

* NIOSH Manual of Analytical Methods, Volume 1, Second Edition, U.S. Government Printing Office, Washington, D.C. (1980).

DATA PROCESSING

Computer software processes all the data and generates descriptive tables and data summaries for each experiment. The programs store data in three primary Statistical Analysis System† (SAS) data sets, as shown in *Figure* 7.

† System designed by the SAS Institute.

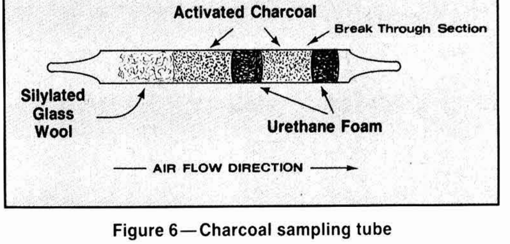


Figure 6—Charcoal sampling tube

Table 2—Solvent Exposure Levels from Interior Latex Paint Solvent Concentration (PPM) vs Sample Location

Date of Experiment = 850220 Test Facility = 230 Test Run Number = 1

Sample Location	X-Dimension Descriptor	Y-Dimension Descriptor	Z-Dimension Descriptor	Number of Samples	Exposure Level PPM
1	Inlet Air	Ventilation	—	1	0.00
2	Outlet Air	Ventilation	—	1	0.35
3	Background	Air Envelope	—	1	0.00
4	Worker–Tube	Breathing Zone	—	1	0.36
5	Worker–Badge	Breathing Zone	—	1	0.00
11	Left Side	Ceiling	Front	1	0.45
12	Left Side	Breathing Zone	Front	1	0.36
13	Left Side	Floor	Front	1	0.28
21	Left Side	Ceiling	Middle	1	0.30
22	Left Side	Breathing Zone	Middle	1	0.28
23	Left Side	Floor	Middle	1	0.25
31	Left Side	Ceiling	Rear	1	0.34
32	Left Side	Breathing Zone	Rear	1	0.22
33	Left Side	Floor	Rear	1	0.25
41	Middle	Ceiling	Front	1	0.33
42	Middle	Breathing Zone	Front	1	0.34
43	Middle	Floor	Front	1	0.22
51	Middle	Ceiling	Middle	1	0.38
52	Middle	Breathing Zone	Middle	1	0.52
53	Middle	Floor	Middle	1	0.25
61	Middle	Ceiling	Rear	1	0.26
62	Middle	Breathing Zone	Rear	1	0.32
63	Middle	Floor	Rear	1	0.48
71	Right Side	Ceiling	Front	1	0.31
72	Right Side	Breathing Zone	Front	1	0.33
73	Right Side	Floor	Front	1	0.26
81	Right Side	Ceiling	Middle	1	0.51
82	Right Side	Breathing Zone	Middle	1	0.26
83	Right Side	Floor	Middle	1	0.30
91	Right Side	Ceiling	Rear	1	0.36
92	Right Side	Breathing Zone	Rear	1	0.32
93	Right Side	Floor	Rear	1	0.31

The information stored in the ESS derived from the gas chromatographic analysis of the individual samples is electronically transferred to the "Analytical" data set. The "Solvent" data set stores the values unique to each solvent, such as molecular weight, evaporation rate, and concentration in the product. Values unique to each experiment, such as environmental conditions and application methods, are stored in the "Experimental" data set. The computer programs merge the data sets and generate tables describing the experiment and data. Tables list the solvent(s) detected, sample locations, number of samples, mean of the time averaged concentrations in the room in ppm, standard deviation, maximum and minimum concentration observed, and the difference in maximum and minimum values (see *Tables* 2 and 3). All reports and data treatments are designed to maximize the benefits of computer data processing.

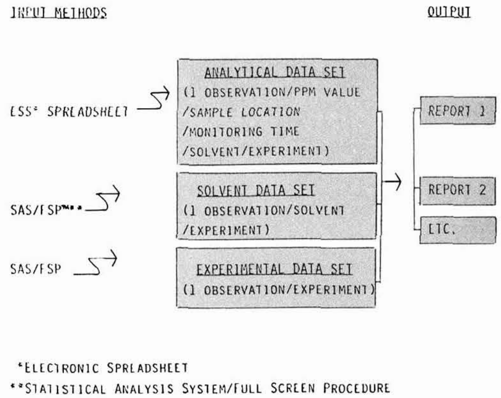


Figure 7—Computer file organization. (Statistical analysis system/full screen procedure courtesy of SAS Institute, Inc., Box 8000, Cary, NC 27511)

EXPERIMENTAL RESULTS

Development of Data on Solvent Exposure From Coalescing Agents in Latex Paints

Diethylene glycol monobutyl ether is used as a coalescing aid in latex paints. The Environmental Protection Agency (EPA) is gathering information on this product to determine if it should be regulated. One of the areas EPA is concerned about is the exposure from its use in latex

Table 3—Solvent Exposure Levels from Interior Latex Paint Statistics by Compound and Sampling Location

Date of Experiment = 850220, Location of Test Facility = 230, Test Run Number = 1

Chemical Name	Sampling Location	Number of Samples Collected	Average of Time-Averaged Exposure Level, PPM	Standard Deviation Of PPM Values	Minimum Time-Averaged Exposure Observed, PPM	Maximum Time-Averaged Exposure Observed, PPM	Difference in Max to Min Values Observed
DB Solvent	Inlet[a]	1	0	—	—	—	—
	Outlet[a]	1	0.35	—	0.35	0.35	—
	Room[a]	27	0.33	0.08	0.22	0.52	0.30
	Worker[a]	1	0.36	—	0.36	0.36	—
	Background[a]	1	0	—	—	—	—
	#52, 6.9 Hours[b]	3	0.18	0.03	0.14	0.20	0.06
	#52, 30.9 Hours[b]	3	0.11	0.04	0.08	0.15	0.07
	#52, 54.4 Hours[b]	3	0.07	0.01	0.06	0.08	0.02

(a) Sampling period = 0.82 hour during product application.
(b) Decay Studies: Three charcoal tubes located at position #52 (center, breathing zone) monitored the air for the specified period *after* the product application ceased.

Table 4—Interior Latex Paint Formula

Component	Weight %
Water	36.58
Preservative	0.26
Thickener	0.43
Dispersant	0.34
Potassium tripolyphosphate	0.09
Surfactant	0.17
Ethylene glycol	1.72
Diethylene glycol monobutyl ether	1.29
Defoamer A	0.18
Titanium dioxide	12.91
Clay	21.51
Silica	5.16
Acrylic resin	18.24
Defoamer B	0.09
Ammonium hydroxide, 28%	0.34
Water	0.69
	100.00
Property	**Value**
Weight % solids	50.4
Volume % solids	31.1
pH	9.2
Weight % coalescing solvent	1.29

paint applied by consumers. To provide data to the EPA, an acrylic-interior latex paint (see *Table* 4 for formulation) containing 1.29 wt% diethylene glycol monobutyl ether was applied by typical roller/brush techniques to a gypsum board substrate within the test facility. The paint was applied by a single operator at a rate of 1.34 gallons per hour using a two-inch brush for trim work and 9-inch medium nap roller for the wall area. Air flow rate was controlled to give a 2.5 air turnover rate in the room per hour. Air sampling was conducted during the painting operation and also after the painting ceased in order to investigate the decay rate of the average solvent concentration in the room. The solvent exposure data are summarized in *Tables* 2 and 3. Analysis of the data leads to the following conclusions:

(1) The time-averaged vapor concentration of diethylene glycol monobutyl ether in the test room was less than one part per million during paint application and decay periods.

(2) The maximum time-averaged vapor concentration recorded for any given sample was 0.52 ppm. (See *Table* 2.)

(3) After cessation of the painting operation, the diethylene glycol monobutyl ether time-averaged solvent concentration decayed rapidly. Six hours after painting stopped, the time-averaged concentration was less than 0.2 ppm. (See *Table* 3.)

(4) The time-averaged solvent vapor concentration was statistically uniform throughout the room. No statistically valid concentration gradients were observed.

(5) The time-averaged vapor concentration in the test room was consistent with data collected concurrently at the worker breathing zone and in the exhaust air stream. (See *Table* 3.)

Table 5—Sampling Codes and Locations For a Typical Test Run

Sample Location	X-Dimension Descriptor	Y-Dimension Descriptor	Z-Dimension Descriptor
1	Inlet Air	Ventilation	—
2	Outlet Air	Ventilation	—
3	Background	Air Envelope	—
4	Worker-Tube	Breathing Zone	—
11	Left Side	Ceiling	Front
12	Left Side	Breathing Zone	Front
13	Left Side	Floor	Front
21	Left Side	Ceiling	Middle
22	Left Side	Breathing Zone	Middle
23	Left Side	Floor	Middle
31	Left Side	Ceiling	Rear
32	Left Side	Breathing Zone	Rear
33	Left Side	Floor	Rear
41	Middle	Ceiling	Front
42	Middle	Breathing Zone	Front
43	Middle	Floor	Front
51	Middle	Ceiling	Middle
52	Middle	Breathing Zone	Middle
53	Middle	Floor	Middle
61	Middle	Ceiling	Rear
62	Middle	Breathing Zone	Rear
63	Middle	Floor	Rear
71	Right Side	Ceiling	Front
72	Right Side	Breathing Zone	Front
73	Right Side	Floor	Front
81	Right Side	Ceiling	Middle
82	Right Side	Breathing Zone	Middle
83	Right Side	Floor	Middle
91	Right Side	Ceiling	Rear
92	Right Side	Breathing Zone	Rear
93	Right Side	Floor	Rear

Development of Data on Solvent Exposure from Glass Cleaner

The purpose of this experiment was to measure exposure levels to ethylene glycol monobutyl ether and isopropyl alcohol solvents during the application of a glass cleaner in a simulated domestic environment. The glass cleaner containing 2.2 wt% ethylene glycol monobutyl ether and 3.3 wt% isopropyl alcohol was applied to the glass surfaces of the window and door of the test room for 0.75 hr at a volume rate of 0.08 gal/hr using a standard pump spray apparatus. Air flow rate was controlled to give an air turnover rate per hour of 1.0. Air sampling was conducted only during the actual cleaning operation. No decay data were collected. Charcoal tubes were located in the positions described in *Table* 5. A summary of the data is given in *Table* 6. Analysis of the data leads to the following conclusions:

(1) The time-averaged room concentration of ethylene glycol monobutyl ether during the application period was less than one part per million.

(2) The time-averaged room concentration of isopropyl alcohol during the application period was 9.07 ± 3.99 parts per million.

(3) No significant time-averaged solvent concentration gradients were observed within the test room during the product application.

(4) The time-averaged ethylene glycol monobutyl ether and isopropyl alcohol solvent concentrations in the

Table 6—Solvent Exposure Levels from Glass Cleaner
Statistics by Compound and Sampling Location
Date of Experiment = 850815, Location of Test Facility = 230, Test Run Number = 1

Chemical Name	Sampling Location	Number of Samples Collected	Average of Time-Averaged Exposure Level PPM[a]	Standard Deviation Of PPM Values	Minimum Time-Averaged Exposure Observed PPM	Maximum Time-Averaged Exposure Observed PPM	Difference in Max to Min Values Observed
EB Solvent	Room	26	0.43	0.22	0.17	1.04	0.87
	Worker-Tube	2	0.52	0.11	0.44	0.60	0.16
	Inlet air	1	<0.12	—	—	—	—
	Outlet air	1	<0.12	—	—	—	—
	Background	1	<0.12	—	—	—	—
Isopropanol	Room	27	9.07	3.99	2.92	20.03	17.11
	Worker-Tube	2	5.49	0.72	4.98	6.00	1.02
	Inlet air	1	<0.24	—	—	—	—
	Outlet air	1	<1.06	—	—	—	—
	Background	1	<0.25	—	—	—	—

(a) Sampling period = 0.75 hours during product application.

room were consistent with the data collected concurrently in the worker breathing zone.

CONCLUSIONS

The solvent exposure test facility constructed by Eastman Chemicals Division provides a scientific means to determine the solvent exposure concentration for various environmental conditions, product compositions, and application techniques. It is believed that the data developed with this facility will provide means to develop a new frontier of knowledge on solvents and other volatile chemicals.

APPENDIX

Sample Collection and Analysis Equipment

Psychrometer Model No. 566
Bendix
Environmental Science Div.
Baltimore, MD 21204

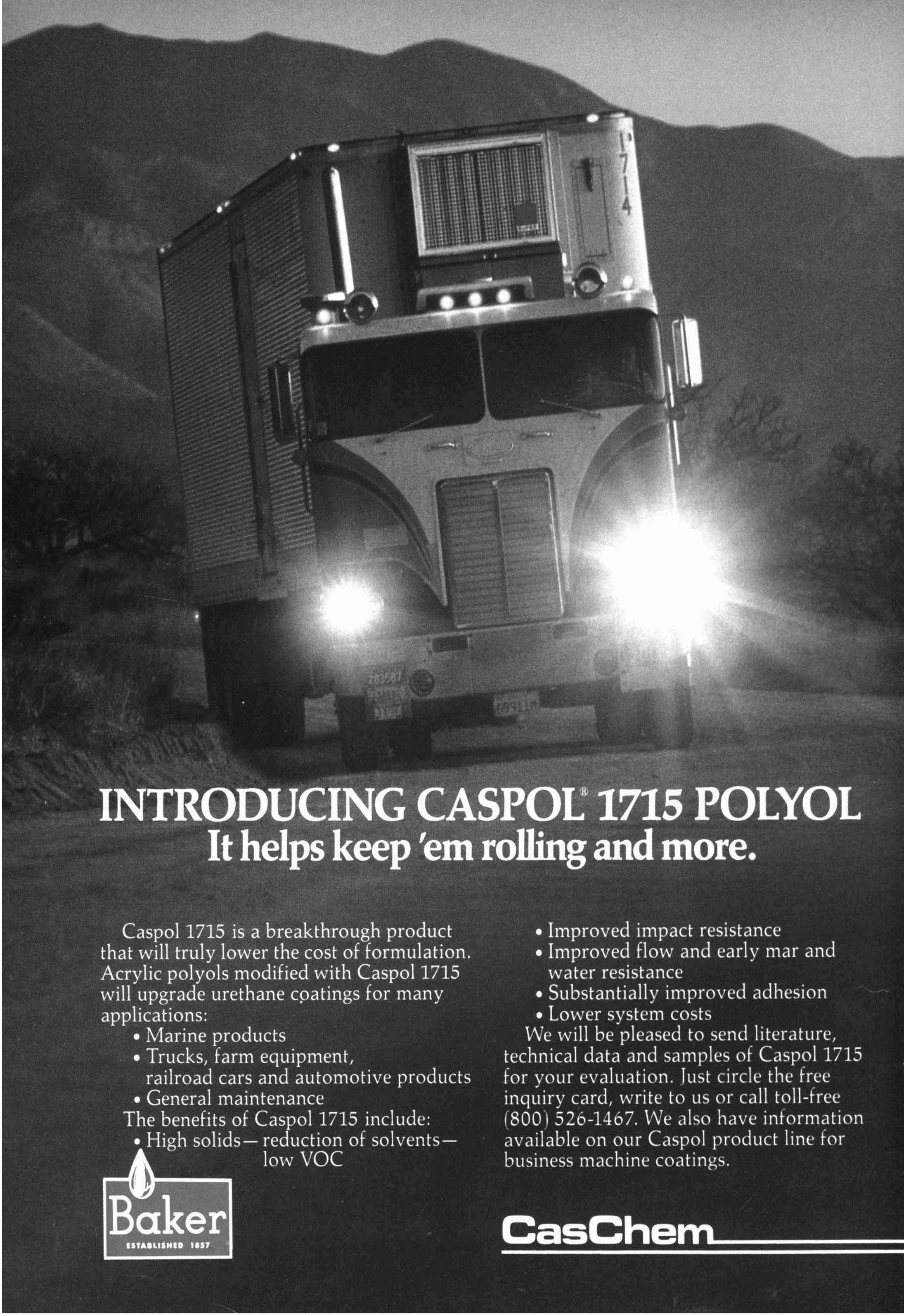
Organic Vapor Monitor 3500
3M Company
Occupational Health and Safety Products Div.
220-7W, 3M Center
St. Paul, MN 55144

Charcoal Tubes, Lot 120
Catalog No. 226-01
SKC, Inc.
R.D. 1, No. 395 Valley View Rd.
Eighty Four, PA 15330

Air Velocity Meter, Model 1650
Thermo Systems, Inc.
500 Cardigan Rd.
P. O. Box 4394
St. Paul, MN 55164

Gas Chromatograph:
Hewlett-Packard Model 5890 equipped with a flame ionization detector

Autosampler:
Hewlett-Packard Model 7671A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Poly-2-Oxazolidone-Urethane Coatings

Hajrija Sehovic, Aisa Sendijarevic, and Vahid Sendijarevic
SODASO Institute of Polyurethanes*

and

Kurt C. Frisch and Shaio-wen Wong
Polymer Institute†

2-Oxazolidone-containing polyurethane coatings were synthesized by the reaction of prepolymers based on poly(oxytetramethylene) glycol (MW 650 and 1000) and four different diisocyanates (MDI, HMDI, H_{12}MDI, and TDI) at various NCO/OH ratios with the diglycidyl ether of bisphenol A (DER 332) catalyzed with LiCl, and the complex compound of LiCl/HMPA in dimethylformamide at 140°C. The procedure of slowly adding the mixture of NCO-terminated prepolymer and epoxide into the catalyst solution at 140°C produced high yields of substituted 2-oxazolidones. The effects of the structure of the diisocyanates and the molecular weight of the polyether polyols on the resulting poly(2-oxazolidone urethane) films were evaluated. These films had excellent flexibility, mechanical properties, and thermal stability.

INTRODUCTION

In recent years there has been considerable development in the synthesis of polymers containing 2-oxazolidone linkages due to their high thermal stability.[1] These polymers are used to prepare elastomers, foams, adhesives, and coatings. The synthetic method, which is of industrial importance, involves the reaction of epoxides and isocyanates.[2] The physico-mechanical properties of the resulting polymers depend on the structure of the diepoxides and diisocyanates employed, the catalysts used, the reaction conditions, and the mode of addition of the reactants.

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Dileone[3] prepared a series of poly-2-oxazolidones by slow addition of diisocyanates to a solution of the diglycidyl ether of bisphenol A and lithium n-butoxide in o-dichlorobenzene/benzene at 160°C. When these thermoplastic materials were molded, they exhibited good bulk mechanical properties, but somewhat insufficient impact strength and elongation. Poly-2-oxazolidones of various diisocyanates and diepoxides were stable in dry air up to 300°C.[4,5]

Ashida and Frisch[6] prepared 2-oxazolidone-containing isocyanurate foams by trimerizing poly-2-oxazolidone-containing polyisocyanate in the presence of a trimerization catalyst. These foams exhibited low combustion and low friability. The same kind of foams were successfully prepared by a one-shot process when a complex catalyst[7] based on a Lewis acid (aluminum chloride) and Lewis base (hexamethylphosphoric triamide) were used in addition to a trimerization catalyst.

Poly-2-oxazolidone-urethane elastomers based on an isocyanate terminated prepolymer (Adiprene® L-100, Uniroyal Chemical Co.) were prepared using a complex catalyst of magnesium chloride and hexamethylphosphoric triamide.[8] The synthesis was accomplished by adding the NCO-terminated prepolymer with vigorous stirring into the diepoxide and catalyst; the mixture was then cured at 150°C for 5 hr. The resulting elastomers had tensile strengths as high as that of polyurethane elastomers, and even higher thermal stability. A small amount of isocyanurate was detected from the IR spectrum.

Thermosetting resins of poly-2-oxazolidone-isocyanurate[9] used as solventless varnishes were prepared from various polyfunctional isocyanates and epoxides at different isocyanate to epoxy ratios (1.0 to 10.0) and curing temperatures; 1-cyanoethyl-2-ethyl-4-methylimidazole

Table 1—Raw Materials

Designation	Chemical Identification	Supplier
Mondur H (HMDI)	1,6-Hexamethylene diisocyanate	Mobay Chemical Co.
Mondur M (MDI)	4,4′-Diphenylmethane diisocyanate	Mobay Chemical Co.
Desmodur W (H_{12}MDI)	4,4′-Methylene bis(cyclohexyl isocyanate)	Mobay Chemical Co.
Adiprene L-357	Prepolymer 2,4-TDI/PTMG 1000 (NCO-6.27%)	Uniroyal Chemical Co.
Terathane 1000 (PTMG 1000)	Poly(oxytetramethylene) glycol (MW 1000)	E.I. Du Pont de Nemours & Co.
Terathane 650 (PTMG 650)	Poly(oxytetramethylene) glycol (MW 650)	E.I. Du Pont de Nemours & Co.
DER-332	Diglycidyl ether of bisphenol-A (epoxy equivalent 172-176)	Dow Chemical Co.
DMF	Dimethylformamide	Eastman Kodak Chemical Co.
LiCl	Lithium chloride	Aldrich Chemical Co.
LiCl-HMPA	Complex catalyst lithium chloride-hexamethylphosphoric triamide	
Cellosolve acetate	2-Ethoxyethylacetate	Union Carbide Corp.
Benzene	—	J.T. Baker

was employed as catalyst. The mechanical properties of the cured resins were changed systematically from brittle to tough by selecting the type and quantity of isocyanates and epoxides.

Kordomenos, et al.[10] reported that coatings of poly(2-oxazolidone-urethane-isocyanurates) had improved impact strength compared to the coatings of poly(2-oxazolidone) and poly(2-oxazolidone-isocyanurate) without sacrificing mechanical properties. The equivalent ratio of 2-oxazolidone, urethane, and isocyanurate in these two coatings was 1:0.5:0.5 for poly(2-oxazolidone-urethane-isocyanurate) and 1:0:1 for poly(2-oxazolidone-isocyanurate). These coatings were prepared from the solution of the NCO-terminated 2-oxazolidone-containing prepolymer and diethylzinc and *tris*-2,4,6-(dimethylaminomethyl) phenol (DMP-30) as catalysts for the formation of 2-oxazolidone and isocyanurate, respectively.

In this study, 2-oxazolidone linkages prepared from different diisocyanates and the diglycidyl ether of bisphenol A were used as hard segments in linear polyurethanes based on poly(oxytetramethylene) glycol with different molecular weights. The effects of the urethane-to-oxazolidone ratio, the catalysts employed, the molecular weight of the soft segment (polyol), and the structure of the diisocyanates on the properties of the resulting poly(2-oxazolidone-urethane) coatings were investigated. The objective of this study was to determine the limiting concentration of urethane groups in a poly(2-oxazolidone) system which would exhibit good impact resistance, yet still maintain its high thermal stability.

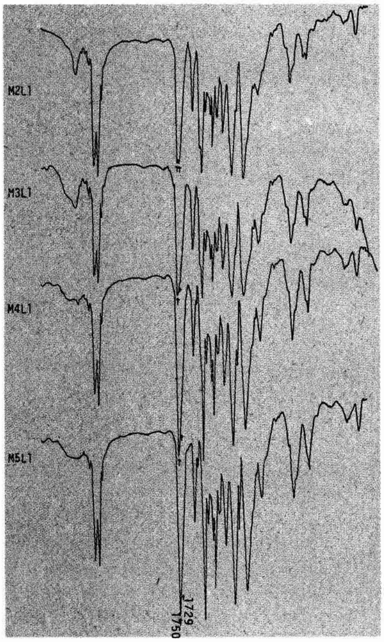

Figure 1—IR spectra of poly(2-oxazolidone-urethanes) based on MDI at various concentrations of 2-oxazolidone

EXPERIMENTAL

Materials

The chemicals used in this study along with their designations and suppliers are shown in *Table* 1. Diisocyanates were used as supplied by the manufacturers without further purification; the NCO content of the isocyanate was measured prior to use. The diepoxides were dried for 24 hr under a vacuum of 1 mm Hg at 75°C. Polyether polyols were also dried at 1 mm Hg at 75°C for a period of 24 hr. Dimethylformamide and Cellosolve® acetate were dried over Linde 4A (Union Carbide Corp.) molecular sieves (220g/500 mL).

Synthetic Procedures

PREPARATION OF COMPLEX CATALYST: The complex catalyst LiCl-HMPA with a molar ratio of 1.1 had a semi-solid consistency and was obtained by directly dissolving lithium chloride in HMPA with vigorous mixing for a period of 24 hr at room temperature. The preparation was carried out in a dry box. HMPA was purified by vacuum distillation, and the anhydrous LiCl (99%) was used without further purification.

PREPARATION OF NCO-TERMINATED PREPOLYMERS: NCO-terminated prepolymers with different NCO/OH ratios were synthesized by the reaction of diisocyanates with poly(oxytetramethylene) glycols in a reactor equipped with a heating mantle, mechanical agitator, and thermometer under constant nitrogen flow. The reaction proceeded at 70°-80°C until the isocyanate content reached the theoretical value which was measured by titration with di-n-butylamine.[11]

PREPARATION OF POLY(2-OXAZOLIDONE-URETHANE) POLYMERS: These polymers were synthesized using the NCO-terminated urethane prepolymers and the bisglycidyl ether of bisphenol A at an equimolar ratio of NCO/epoxide. The catalyst (3 millimoles) was dissolved in 110 mL of dimethyl formamide, and in some instances, a mixture of 55 mL of Cellosolve acetate and 55 mL of dimethylformamide. A mixture of 0.1 equivalent each of diepoxide and prepolymer, maintained at approximately 60°C, was added through a dropping funnel with vigorous stirring to the catalyst solution in a nitrogen stream over a period of 45 min at 140°C. The reaction was monitored by measuring the disappearance of isocyanate and epoxide[12] until completion (ca. 2 hr). A film of 10 mil thickness was applied on a glass, aluminum, or steel panel and dried in a vacuum overnight at 100°C.

Characterization of Polymers

Infrared spectroscopy was carried out with a Fourier Transform spectrometer (FTIR, Nicolet DX-5). A film was prepared on a KBr plate from the polymer solution, and the solvent was removed by vacuum.

The stress-strain properties of the polymer films were measured at room temperature at a crosshead speed of 5 in./min on an Instron Tensile Tester (Table model 1130) according to ASTM D 638-68. The standard microdie was used for testing. The film thickness was measured with an Elcometer (Elcometer Instrument Ltd.). For every specimen, 10 measurements were taken and the average was used for determining the tensile strength and elongation. Gardner impact measurements (direct and indirect) were made on coated steel plates. The hardness was determined with a pencil tester according to the ASTM D 3363 (Gardco Pencil Hardness) method.

The thermal stability of the polymers was measured under a nitrogen stream (1.5 cfh) on a Thermal Gravimetric Analyzer (TGA 950, Du Pont Instrument Co.) at a heating rate of 15°C/min. The weights of the specimens were about 20 mg. Isothermal TGA measurements were also carried out at 270°C in a nitrogen stream for a period of 5 hr.

RESULTS AND DISCUSSION

Nomenclature

The thermoplastic poly(2-oxazolidone-urethane) polymers were synthesized by the reaction of NCO-terminated urethane prepolymers of different NCO/OH ratios and the diglycidyl ether of bisphenol A (DER 332) in solvent. The diisocyanates employed were 4,4′-diphenylmethane diisocyanate (M), 2,4-toluene diisocyanate (T), 4,4′-methylene bis(cyclohexyl isocyanate) (W), and 1,6-hexamethylene diisocyanate (H). Two catalysts, lithium chloride (L) and the complex of lithium chloride and hexamethylphosphoric triamide (LH), and two polyether polyols, poly(oxytetramethylene) glycols of molecular weight 650 (designated 06) and 1000 (designated as 1) were used for the synthesis. For convenience, a code consisting of two sets of letters and numerals was used for

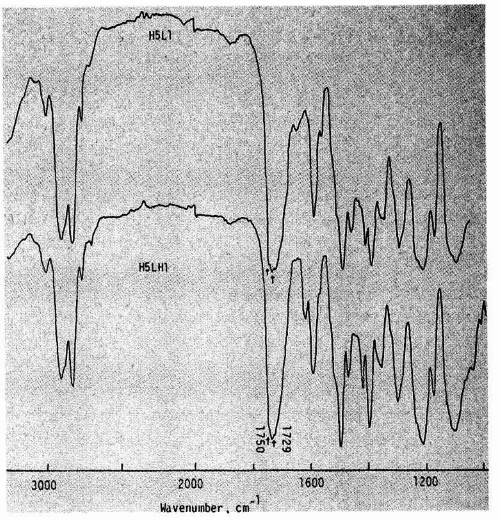

Figure 2—IR spectra of poly(2-oxazolidone-urethanes) based on MDI prepared with different catalyst systems

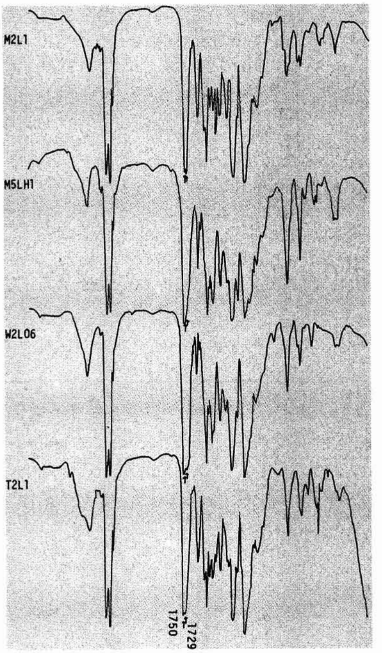

Figure 3—IR spectra of poly(2-oxazolidone-urethanes) based on various diisocyanates

Table 2—Properties of Poly(2-Oxazolidone-Urethanes) Based on MDI and DER 332

Designation	M2L1	M3L1	M4L1	M5L1	M2L06
Wt% of polyol	54.6	41.4	33.4	27.9	43.9
Appearance	Clear	Hazy	Hazy	Translucent	Translucent
Pencil hardness	6H	4H	8H	8H	8H
Gardner impact lb/in					
Direct	160	140	120	10	140
Reverse	120	120	80	10	80
Tensile strength, psi	4000	5577	6041	Brittle	3224
(MPa)	(27.6)	(38.5)	(41.7)		(22.2)
Elongation, %	600	440	320	Brittle	320
Solvent resistance[a]	NE	NE	NE	NE	NE

(a) In acetone, benzene, and toluene NE = no effect.

each polymer to identify its composition. The first letter denotes the diisocyanate, followed by a numeral which denotes the ratio of NCO/OH in the prepolymer. The third letter (or letters) denotes the catalyst used and is followed by a numeral indicating the molecular weight of the polyol (soft segment). Thus, the code M2L1 represents a poly(2-oxazolidone-urethane) which is synthesized from a prepolymer of MDI and PTMG 1000, at a NCO/OH ratio of 2 and DER 332 using lithium chloride as catalyst.

Characterization of Poly(2-Oxazolidone-Urethane)

Confirmation of the formation of 2-oxazolidone linkages was made by infrared spectra. The IR spectra of these polymers exhibited a strong and broad absorption in the region of 1730-1770 cm^{-1} and in no instances was there any absorption at 2270 cm^{-1}; characteristic of the isocyanate group. The results by the titration methods also failed to detect any isocyanate and epoxide groups remaining in the solution at the completion of the reaction. The characteristic absorptions of the carbonyl group of the 2-oxazolidone and urethane are 1750 and 1730 cm^{-1}, respectively. The polymers at a ratio of 1:1 of oxazolidone to urethane (such as polymer M2L1) showed two peaks of about the same intensity at 1729 and 1750 cm^{-1}, which represent the urethane and oxazolidone linkages present in the system. As the ratio of oxazolidone to urethane increased, the urethane absorption peak became weaker. Finally, the absorption at 1750 cm^{-1} dominated when the oxazolidone to urethane ratio reached 3/1 (polymer M4L1), as shown in *Figure* 1. When the complex catalyst LiCl/HMPA was used in the synthesis of the polymer based on 1,6-hexamethylene diisocyanate (H5LH1, *Figure* 2), the IR spectrum showed a much broader absorption in the region of 1720 to 1760 cm^{-1}, indicating that the complex catalyst LiCl/HMPA was not as effective as LiCl. The IR spectra of polymers based on different diisocyanates are shown in *Figure* 3. The strong absorption at 1750 cm^{-1} indicates the high yield of oxazolidone in the system. No indication of the presence of significant amounts of isocyanurate was detected in the system according to the IR spectrum. The synthetic procedure used in this investigation, a slow addition of the mixture of diisocyanate and diepoxide to the catalyst solution, gave a high yield of 2-oxazolidone and very small amounts of products from side reactions. A homogeneous solution was maintained throughout the reaction, even after cooling. It was surprising that the reaction was completed in two hours at a relatively low temperature (140°C) compared to the other previously reported procedures.[3,8-10] Herweh, et al.[4,13] used the same procedure to achieve high yields of 2-oxazolidones and poly(2-oxazolidones) at a higher temperature and longer reaction time.

Properties of Poly(2-Oxazolidone-Urethanes) Based on MDI

The properties of poly(2-oxazolidone-urethanes) based on DER 332 and prepolymers of MDI and PTMG polyols at various NCO/OH ratios, catalyzed with LiCl, are shown in *Table* 2. Since the major contribution to the flexibility of the polymer is from the poly(oxytetramethylene) chain, the weight percent of polyol in the system represents the soft segment of the thermoplastic polymer. It was apparent that with increasing soft segment content, the films became softer, with decreasing tensile strength yet increasing elongation and impact strength. The films

Table 3—Properties of Poly(2-Oxazolidone-Urethanes) Based on HMDI and DER 332

Designation	H2L1	H3L1	H4L1	H5L1	H5LH1[a]	H5L06
Wt% of polyol	60.0	46.1	37.5	31.6	31.6	23.1
Appearance	White color	Hazy	Hazy	Hazy	Hazy	Hazy
Pencil hardness	6B	4B	HB	6H	6H	8H
Gardner impact lb/in						
Direct	160	160	160	160	160	160
Reverse	160	160	140	140	160	160
Tensile strength, psi	Sticky	Sticky	Sticky	2738	Not Tested	3861
(MPa)	Tacky			(18.9)	Not Tested	(26.6)
Elongation, %	—	—	—	530	Not Tested	450
Solvent resistance	NE	NE	NE	NE	NE	NE

(a) The solvent used was a mixture of 55 mL of Cellosolve acetate and 55 mL of dimethylformamide.

Table 4—Properties of Poly(2-Oxazolidone-Urethanes) Based on H_{12}MDI and 2,4-TDI with DER 332

Designation	W2L06	T2L1
Wt% of polyol	43.2	59.5
Appearance	Opaque, white	Hazy, pale yellow
Pencil hardness	6H	8H
Gardner impact lb/in		
Direct	160	160
Reverse	140	160
Tensile strength, psi (MPa)	5025 (34.6)	2053 (14.2)
Elongation, %	420	760
Solvent resistance	NE	NE

were clear at high polyol content but became hazier as the polyol content decreased and were translucent at 28 wt% of polyol, which corresponds to the polymer M5L1. The film properties changed suddenly at a polyol content of 28 wt% to hard and brittle and the impact resistance decreased. It can be concluded that 33 wt% of PTMG polyol is needed to have adequate impact resistance of the MDI-based poly(2-oxazolidone-urethane), yet still maintain good stress-strain properties.

The poly(2-oxazolidone-urethane-isocyanurate) film, based on MDI, DER 332 and poly(oxypropylene) glycol of MW 1000, prepared by Kordomenos, et al.[10] had lower tensile strength (2900 psi vs 6000 psi) and much lower elongation (60% vs 320%) when compared to the polymer M4L1. Although the polyol content of the first film was somewhat higher (37.5 wt% vs 33.4 wt%), the presence of the isocyanurate ring might cause the film to be more brittle. There was also the difference between PTMG and PPG polyols. The difference in the synthetic procedures may also have an important effect on the physical properties of the resulting polymers.

The effect of molecular weight of the PTMG polyol on the film properties can be demonstrated in polymers M2L1 and M2L06. The film made from the lower molecular weight polyol (M2L06) was harder, had lower impact resistance and elongation than polymer M2L1, and about the same tensile strength as polymer M2L1. This is expected since the soft segment content in polymer M2L06 was lower than that of polymer M2L1.

Poly(2-Oxazolidone-Urethanes) Based on HMDI

Table 3 shows the properties of poly(2-oxazolidone-urethanes) based on DER 332 and the prepolymers of HMDI and PTMG polyols at various NCO/OH ratios, catalyzed with LiCl and LiCl/HMPA. Due to the flexible hexamethylene chain in HMDI, the polymers with the same NCO, OH, and epoxide ratios were much softer than the corresponding MDI-based polymers. The films containing more than 37 wt% of polyol were tacky, although they showed excellent solvent resistance. The film containing a high concentration of 2-oxazolidone rings (polymer H5L1), was white and somewhat cloudy, exhibited properties comparable to polymer M2L1.

When the LiCl/HMPA catalyst was used in the system, equal amounts of Cellosolve acetate and dimethylformamide were added to keep the polymer from precipitating. The resulting film showed excellent impact strength and solvent resistance.

The effect of the molecular weight of the polyol in HMDI-based poly(2-oxazolidone-urethanes) was the same as in the MDI-based poly(2-oxazolidone-urethanes).

Poly(2-Oxazolidone-Urethanes) Based on H_{12}MDI and TDI

The physical properties of poly(2-oxazolidone-urethanes) based on DER 332 and the prepolymers of TDI and H_{12}MDI and PTMG polyols at an NCO/OH ratio of 2/1, catalyzed with LiCl are shown in *Table* 4. The TDI-based prepolymer is a commercial product, Adiprene L-357, containing 2,4-toluene diisocyanate. Due to the asymmetrical structure of the 2,4-TDI, the soft and hard segments in the polymer system do not arrange as regularly as the symmetrical 2,6-TDI.[14] Hence, the resulting polymer had higher elongation and impact resistance compared to the film based on MDI with the same stoichiometric ratio of NCO/OH/epoxide. The film was pale yellow in color and was a little hazy.

The film based on H_{12}MDI was much stiffer than that based on HMDI due to the cyclic ring structure in the diisocyanate. The commercial product H_{12}MDI consists of a mixture of three isomers,[15] which makes the H_{12}MDI-based polyurethane optically clear. However, the poly(2-oxazolidone-urethane) film based on this diisocyanate appeared opaque and white in color, presumably due to some phase separation.

Among the films based on four different diisocyanates (compared at the same stoichiometric ratio), the film based on HMDI was very soft and tacky. The film based on TDI had the best impact resistance and elongation,

Table 5—Thermal Stability of Poly(2-Oxazolidone-Urethanes)

Designation	Wt % of Polyol	Temperature °C 2% Wt Loss	Temperature °C 10% Wt Loss	% of Wt Loss After 5 Hrs at 270°C
M2L1	54.6	300	350	7
M3L1	41.4	300	360	—
M4L1	33.4	300	360	—
M5L1	27.9	300	365	4
M2L06	43.9	290	335	8
H5L1	31.6	260	340	—
H5L06	23.1	275	325	6
W2L06	43.2	300	350	3
T2L1	59.5	260	325	9

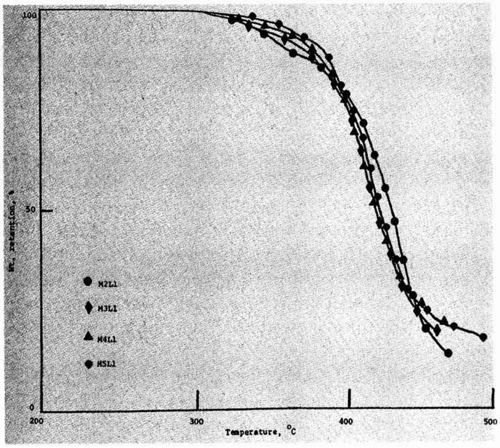

Figure 4—TGA thermograms of poly(2-oxazolidone-urethanes) based on MDI at various concentrations of 2-oxazolidones

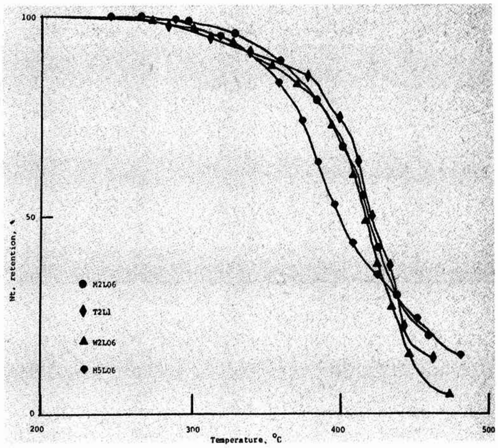

Figure 5—TGA thermograms of poly(2-oxazolidone-urethanes) based on various diisocyanates

followed by MDI and $H_{12}MDI$. The films based on MDI and $H_{12}MDI$ had excellent tensile properties.

Thermal Stability

The thermal stability of the poly(2-oxazolidone-urethanes) was measured by TGA (both temperature scan and isothermal at 270°C). *Table* 5 summarizes the results of the analyses. The temperatures at which 2% and 10% weight losses occurred (at a heating rate of 15°C/min under nitrogen atmosphere), and the weight loss after 5 hr of heating at 270°C were recorded. *Figure* 4 shows the thermograms of poly(2-oxazolidone-urethanes) based on MDI at various urethane to oxazolidone ratios. As the 2-oxazolidone concentration increased, the decomposition temperature increased. The results from the isothermal TGA also indicated that M5L1 was more stable than M2L1. The thermograms of the four films based on different diisocyanates are shown in *Figure* 5. The thermal stability of these films can be arranged in order of decreasing stability as follows: W2L06>M2L1>T2L1>H5L06.

CONCLUSIONS

(1) The synthetic procedure of the slow addition of the mixture of a NCO-terminated prepolymer and an epoxide to the catalyst solution at 140°C gave high yields of 2-oxazolidones.

(2) Lithium chloride was found to be a better catalyst to promote the formation of 2-oxazolidone linkages than the complex catalyst of lithium chloride/hexamethylphosphoric triamide.

(3) The poly(2-oxazolidone-urethanes) prepared from prepolymers based on poly(oxytetramethylene) glycols (MW 1000 and 650) and four diisocyanates, (MDI, HMDI, $H_{12}MDI$, and TDI) and the diglycidyl ether of bisphenol A (DER 332) exhibited excellent thermal stability, and good mechanical properties, with the exception of the HMDI-based polymers which showed some tackiness at higher polyol content in the NCO-terminated prepolymers.

(4) The concentration of the soft segment (polyether polyol) necessary to improve the flexibility (impact strength) of the 2-oxazolidone containing polymers based on DER 332 can be varied depending upon the structure of the diisocyanates and the molecular weight of the polyol employed without sacrificing thermal and mechanical properties.

ACKNOWLEDGMENTS

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References

(1) Kordomenos, P.I., Kresta, J.E., and Frisch, K.C., *ACS Org. Coatings and Plastics Preprints*, 38, 450 (1978).
(2) Speranza, G.P. and Peppel, W.J., *J. Org. Chem.*, 23, 1922 (1958).
(3) Dileone, R.R., *J. Polymer Sci.*, A-1, 8, 609 (1970).
(4) Herweh, J.E. and Whitmore, W.Y., *J. Polymer Sci.*, A-1, 8, 2759 (1970).
(5) Braun, D. and Weinert, J., *Angew Makromol. Chemie*, 78, 1 (1979).
(6) Ashida, K. and Frisch, K.C., *J. Cell. Plastics*, 8, 194 (1972).
(7) Ashida, K., International Conference on Cellular and Non-Cellular Urethanes, S.P.I. and S.F.K., Strasbourg, France, June 1980, Preprint book, Carl Hanser Verlag, pp 349-358.
(8) Kitayama, M., Iseda, Y., Odaka, F., Anzai, S., and Irako, K., *Rubber Chem. Technol.*, 53, 1 (1980).
(9) Kinjo, N., Numata, S., Koyama, T., and Narahara, T., *J. Appl. Polymer Sci.*, 28, 1729 (1983).

(10) Kordomenos, P.I., Frisch, K.C., and Kresta, J.E., "Oxazolidone Coatings. Part I: Synthesis and Structure" and "Oxazolidone Coatings. Part II: Structure-Properties Relationships and Thermal Stability," JOURNAL OF COATINGS TECHNOLOGY, 55, No. 700, 49 and 59 (1983).

(11) David, D.J. and Staley, H.B., "Analytical Chemistry of Polyurethanes," *High Polymers* (Part III), Vol. XVI, Wiley-Interscience (1969), p. 115.

(12) Dijkstra, R. and Dahmen, A.M.F., *Anal. Chim. Acta.*, *31*, 38 (1964).

(13) Herweh, J.E. and Kauffman, W.J., *Tetrahedron Letters*, No. *12*, 809 (1971).

(14) Sung, C.S.P. and Schneider, N.S., "Polymer Alloys," D. Klempner and K.C. Frisch, eds., Plenum, New York, (1977), p. 261.

(15) Wong, S., Frisch, K.C., Byrne, C.A., Mack, D.P., and Schneider, N.S., *Advan. Urethane Sci. and Technology*, 9, 77 (1984).

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^{13}C NMR Determination of Lactic Acid Concentration in Cathodically Electrodeposited Coatings

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Ford Motor Company*

The level of lactic acid in films formed by cathodic electrodeposition on steel has been determined as a function of the ratio of acid to amine (percent neutralization) in the electrocoat bath and as a function of deposition conditions. Using ^{13}C NMR together with ^{13}C enriched lactic acid, it is shown that the level of lactic acid in deposited films is less than 0.01 wt %, a reduction of 99.9% from the coating bath. This result is independent of percent neutralization and deposition voltage and time. The level of acid retained during cathodic deposition is much less than the level of amine retained during anodic deposition.

INTRODUCTION

Cathodic electrodeposition is widely used to prime conductive substrates such as steel. Several review articles have been published describing the mechanism and kinetics of the electrodeposition process.[1-3] Typically, cathodic electrocoats consist of an amine functional organic resin neutralized with an organic acid. This material can be dispersed in water along with pigments, cosolvents, and other additives. During cathodic deposition, hydroxide ion is generated at the substrate (cathode) causing coagulation of the resin on the substrate. Protons generated at the anode react with the anion regenerating the acid. The composition of the film can differ substantially from the bath since it depends on deposition kinetics as well as bath composition. In particular, it is expected that the level of neutralizing acid in the film will be much less than that in the bath.[1]

Materials based on epoxy-amidoamine resins have been developed in this laboratory for use as low bake temperature cathodic electrocoats.[4] In this resin system, the neutralizing acid is necessary both to form the aqueous dispersion as well as to prevent epoxy-amine reaction.[5] After deposition, it is found that epoxy-amidoamine films cure rapidly at temperatures as low as 250°F. Although the films are well-cured, the corrosion performance of these coatings decreased with decreasing bake temperature. A possible explanation for this behavior is that some of the lactic acid in the bath is incorporated into the deposited film in the form of an amine-acid salt. As has been shown, the presence of acid-amine salts are deleterious to corrosion performance in similar coating systems.[6] The improved corrosion performance at higher bake temperatures results, presumably, from an increase in the rate of decomposition of the acid-amine salt at higher temperatures. The presence of small amounts of acid in the film was expected on the basis of earlier work on anodic electrocoat systems where as much as 10% of the neutralizing amine was found in deposited coatings using radioactive tracer techniques.[7]

This report presents the results of a ^{13}C Nuclear Magnetic Resonance (NMR) determination of the concentration of acid in electrodeposited films. An amine functional epoxy resin served as the coating material. Lactic acid was used as the neutralizing agent. In the following section, the samples and their preparation are described along with the details of the NMR technique. Results are discussed in terms of the implications for the epoxy-amidoamine system and in comparison with the early study of anodic systems.

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EXPERIMENTAL

Materials

All resins, reagents, and solvents were used without further purification. The epoxy resin Epon® 1004F was obtained from Shell Chemical Co., diethanolamine and hexylcellosolve from Union Carbide Corp., and lactic acid from Fisher Scientific. Carbonyl carbon ^{13}C enriched (90%) sodium lactate was purchased from Aldrich Chemical, while DMSO-d6, used to prepare the NMR samples, came from MSD Isotopes.

Resin Synthesis and Dispersion Preparation

The epoxy-amine adduct was prepared by reacting stoichiometric amounts of Epon 1004F with diethanolamine at 90% solids in hexylcellosolve.[6] The amine equivalent weight of the resin was 1000. Dispersions of the diadduct in deionized water were prepared with either 75%, 100%, or 125% neutralization of the amine by lactic acid. After neutralization, an additional amount of the ^{13}C enriched Na lactate, corresponding to 10% by equivalents of the lactic acid, was introduced into each bath to act as a marker to follow the fate of the lactic acid.

Electrodeposition

Electrodeposition was carried out in a beaker containing the dispersion (kept under mild agitation) and a graphite anode connected to a Hewlett Packard 6483C DC power supply. A small rectangular tab of conversion coated steel immersed in the bath served as the cathode and surface for film formation. In a typical experiment, the voltage was brought to 100 V in 15 sec and maintained for 2 min. Voltages and deposition times were varied, however, as noted in the following. After deposition, the steel tab was rinsed with distilled water and then dried for 5 min in an air circulating oven at 50°C.

Preparation of the Samples For the NMR Experiments

NMR samples were obtained both from the bath and from deposited films. Samples from the bath dispersion were prepared as follows: 6 mL of acetone was added to 2 mL of two of the dispersions (75% and 100% neutralized) to coagulate the dispersion. These mixtures were then allowed to evaporate overnight in a hood. The following samples were obtained from the electrodeposited films:

(1) Deposition was from the 75% bath at 100 V for 2 min. The coating was scraped off with a hard rubber spatula. The scraped tab was then rinsed with a few drops of hexylcellosolve which was added to the scrapings.

(2) Same coating as (1). Instead of scraping, the coating was dissolved off in methyl ethyl ketone (MEK). The solvent was then allowed to evaporate.

(3) Same coating as (1). The coating was merely scraped off with no rinsing.

(4) Prepared exactly as (1), except that the 100% bath was the film source.

(5) Prepared exactly as (1), except that the 125% bath was the film source.

(6) Prepared exactly as (1), except that the 125% bath was the source and deposition was at 40 V.

(7) Same as for (1), except using the 125% bath at 200 V and depositing for only 5 sec.

NMR Techniques

High resolution ^{13}C NMR spectra were acquired of the coagulated dispersions and of the scraped electrodeposited coatings at 75.4 MHz using a Bruker MSL 300. All of the samples were highly viscous and showed broadened NMR lines when mixed with only a small amount of DMSO-d6 to act as the lock. To obtain sufficiently narrow linewidths, samples were prepared using only 1 mL of material with 3 mL of DMSO-d6 in 10 mm NMR tubes. The ppm scale was referenced to the chemical shift of the center line of the DMSO-d6 septet of 39.5 ppm.

As was expected, the bath samples gave a densely populated NMR spectrum. In the carbonyl region, only two lines were observed, and consequently it was quite easy to identify the resonance from the ^{13}C enriched carbonyl carbon of the Na lactate. Since the acquisition of the entire spectrum would have posed a dynamic range problem if only a small amount of lactic acid entered the electrodeposited coat, it was decided to limit the spectral width to only the carbonyl region (145-185 ppm). This region included the lactate carbonyl resonance and one line from the epoxy amine diadduct to act as the intensity reference. The spectrometer frequency was offset to the center of this region and the pulse power significantly attenuated. Under this condition, the 90° pulse width for the carbon lines in this region became 200 μsec. The reduction of the pulse power and lengthening of the pulse was done to limit the excitation to only these two carbons. If this technique had not been employed, aliasing by the strong resonances outside of the spectral window would have created severe overlap problems. The broad band proton decoupler was on only during the acquisition to reduce the build-up of the Nuclear Overhauser Effect (NOE).[8] The recycle time was maintained at close to eight times the T_1 of the two carbons to allow the relaxation of any NOE that developed during the acquisition period.[9]

RESULTS

Figure 1a shows the carbonyl region of the ^{13}C, broad band decoupled NMR spectrum of the 100% neutralized dispersion. The lactate resonance is at 177.16 ppm. The integral of this peak is 1.47 compared to 1.00 for the reference line at 156.53 ppm. This spectrum thus establishes a basis for the quantitative comparison of the amount of ^{13}C enriched lactate in the dispersion compared to the unenriched epoxy diadduct. Although the polymer reference line has a small neighboring peak, this does not present a problem since integrals were compared. Two additional dispersion mode-like resonances at 147.5 ppm and 162.5 ppm and a small negative peak at 176 ppm are aliased from outside the spectral window. The low field alias peak is most likely residual acetone.

The seven electrodeposition samples were prepared to cover a range of sample preparation, neutralization, and deposition conditions. NMR spectra from samples (1-3) were identical except for differing amounts of aliased ketonic carbon resonance from MEK or acetone, demonstrating that the results are independent of sample preparation techniques. NMR spectra from samples at 75%, 100%, and 125% neutralization [(1), (4), and (5)] are shown in *Figures* 1b-d. Spectra from samples (6) and (7) were identical to (5). The spectrum of sample (6) (not shown) was signal averaged for three days to produce a spectrum of extremely high signal-to-noise (>100:1 for the reference signal). No trace of a lactic line was visible in any of the spectra from the deposited films. Integrated intensities in the lactate region ranged from −0.05 to 0.001 relative to the reference signal. Based on this data, it can be concluded that the concentration of lactic acid in the coating is at least 1000 times smaller than it is in the bath (relative to resin solids). Since the concentration of lactic acid in the bath ranges from 6.9 to 11.4% by weight resin solids, the concentration of lactic acid in the film is less than 0.01% by weight.

DISCUSSION

During the electrodeposition process, the epoxy-amine resin is deposited on the cathode while the neutralizing acid is attracted to the anode.

Cathodic Reactions:

$H_2O + e \longrightarrow 1/2\ H_2 + 2OH$

Polymer-NH^+ + OH ----> Polymer-N + H_2O

(Dispersed) (Insoluble)

Anodic Reactions:

$H_2O \longrightarrow 1/2\ O_2 + 2H^+ + 2e$

$H^+ + RCOO \longrightarrow RCOOH$

Given the total lack of lactic acid in the deposited film, it is clear that these reactions are exceedingly efficient at separating the acid-amine salt in the dispersion and removing lactic acid from the film, even in dispersions that have an excess of acid to amine and at low deposition voltages. This efficiency is surprising in view of the fact that film formation occurs when enough amine groups react with hydroxide groups to destabilize the dispersion. From studies of dispersion preparation at low neutralization, it is estimated that these dispersions become unstable at neutralizations below 30-50%. Thus, at the very initial stages of film formation, the concentration of acid should be at least 30%. Apparently after initial destabilization and deposition, subsequent hydroxide ions generated at the cathode drive out the residual lactate ion. The expulsion of lactate ion from the film must be rapid since depositions as short as 5 sec [sample (7)] exhibit no traces of lactic signal.

The absence of any lactic acid-amine salt in the cathodically deposited films is consistent with the rapid cure of the epoxy-amidoamine coatings. Once the acid is removed from this coating, epoxy-amine reactions will occur rapidly. On the other hand, it is clear that residual acid-amine salts cannot be responsible for the decrease in corrosion resistance of these materials at low bake temperatures, as was postulated earlier. Some other explanation must be sought. For example, some other species (as high boiling solvent or plasticizer) may be responsible. Alternatively, there may be some specific coating-substrate interaction which only occurs at higher temperature.

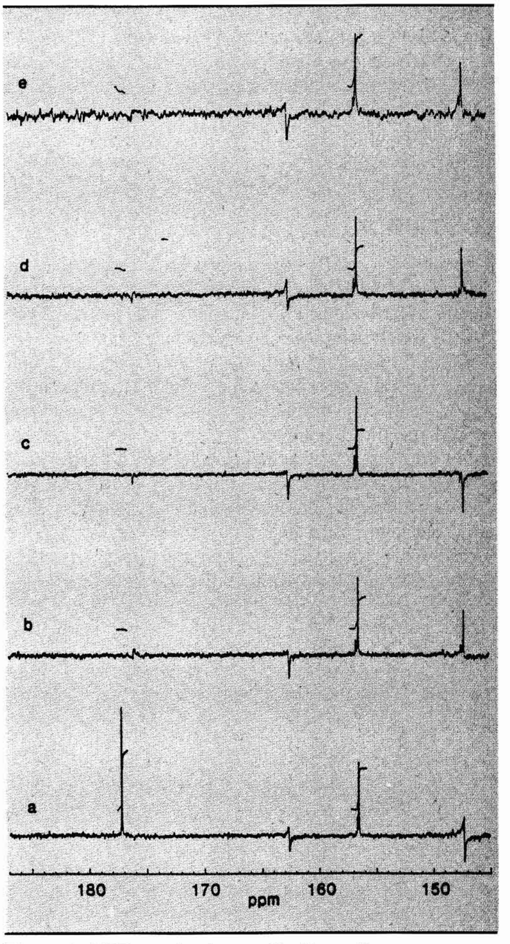

Figure 1—NMR spectra from cathodic coatings over range 145-185 ppm. The peaks are identified in the text. Spectrum a is for the coagulated dispersion; b is for sample (1); c is for sample (4); and d is for sample (5)

The total lack of acid in the deposited coatings can be contrasted with an earlier study of amine levels in anodically deposited coatings.[7] In these experiments, it was found that as much as 8% of the neutralizing amine is retained in the coating (equivalent to 0.1-0.6% amine by weight in the coating). These values are much higher than our lower detection limits (0.01%). Since the mechanism for film formation in the anodic and cathodic processes is essentially the same, this difference must be related to a secondary reaction that differs between the two processes. One possible explanation is that in the anodic process, metal dissolution can occur. In principle, it does not occur in cathodic deposition.[1] The level of dissolved metal in anodic films is similar to the level of amine found in these films (2-7% based on the number of coulombs passed in the deposition).[10] It may be that the amine forms a complex with the dissolved metal ion and is retained in the coating. The lower level of acid-amine salt in cathodic coatings may contribute to the improved corrosion resistance usually observed in cathodic coatings.[2]

CONCLUSION

Quantitative NMR experiments have shown that the amount of lactic acid remaining as an amine salt in cathodically electrodeposited coatings is vanishingly small (<0.01 wt%), independent of the extent of amine neutralization in the coating bath and of the deposition conditions. The high sensitivity achieved in these experiments was a result of using partially enriched lactic acid and special spectral techniques. The lack of acid in the cathodic coatings is in contrast with results on anodic electrodepositions which found amine levels as high as 0.6%. The lower level of acid-amine salt in the cathodic coating may contribute to the improved corrosion resistance observed in cathodic systems. These experiments point out the rich possibilities when precise NMR experiments are combined with isotopic labeling for the analysis of specific components in coatings.

References

(1) Beck, F., *Progr. Org. Coat.*, *4*, 1 (1976).
(2) Pierce, P.E., "The Physical Chemistry of the Cathodic Electrodeposition Process," JOURNAL OF COATINGS TECHNOLOGY, *53*, No. 672, 52 (1981).
(3) Schenk, H.U., Spoor, H., and Marx, M., *Progr. Org. Coat.*, *7*, 1 (1977).
(4) Swider, R.A. and Horsch, M.E., U.S. Patent 4,568,710, Feb. 4, 1986.
(5) Qaderi, S.B.A., Paputa-Peck, M.C., and Bauer, D.R., *J. Appl. Polymer Sci.*, submitted.
(6) Qaderi, S.B.A., Bauer, D.R., Holubka, J.W., and Dickie, R.A., "Water-Borne Coatings Based on Epoxy-Alkanolamine Resins," JOURNAL OF COATINGS TECHNOLOGY, *56*, No. 719, 71 (1984).
(7) Blank, W.J., Koral, J.N., and Petropoulos, J.C., "Performance Characteristics of Amino Cross-Linked Saturated Resin Systems in Electrocoating Paints," JOURNAL OF PAINT TECHNOLOGY, *42*, No. 550, 609 (1970).
(8) Shoolery, J.N., *Progr. NMR Spectr.*, *11*, 79 (1977).
(9) Opella, S.J., Nelson, D.J., and Jardetzky, O., *J. Chem. Phys.*, *64*, 2533 (1976).
(10) May, C.A. and Smith, G., "Dissolution of the Anode During the Electro-deposition of Surface Coatings," JOURNAL OF PAINT TECHNOLOGY, *40*, No. 526, 494 (1968).

Applications of Computer Data Base Management In Polymer and Coatings Research

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The recently acquired ability of the scientist to have easy access to uncomplicated computerized data base management utilities without the necessity of, and the constraints connected with, involving systems personnel in these projects has provided the opportunity to store, retrieve, and analyze data in ways which would not have been practical or even possible before. The data base applications range from very large, complex systems which may have a life of many years, to fairly small, short-term, personal data bases. This paper attempts to describe a range of applications of data base management implemented in our laboratories. These applications include managerial applications such as project monitoring and patent disclosure tracking; information retrieval applications such as a research report index, lab notebook tracking, and file indexing; and technical data retrieval and analysis applications involving exposure test data and laboratory experimental data.

Introduction

Computer Data Base Management Systems (DBMS) are not new. DBMS has been used on large mainframe computer systems for traditional business applications for many years. Most simply stated, a DBMS is a program which allows the user to perform various standard operations involved in the storage, maintenance, and retrieval of data stored in organized files on a computer without the need to write a program. Common functions available in DBMS packages include STORE, SORT, MODIFY, DELETE, and SEARCH. Usually these packages have the ability to generate standard procedures or sequences of commands for frequently used operations and for the generation of formatted reports, but their most powerful feature lies in the ability of the user to query the system to retrieve information based on the contents of one or more of the data fields in the file, or to cross-index information between different fields.

Recently, with the revolution in mini and microcomputers and disk storage, DBMS packages have become readily accessible to the scientist. In addition, the DBMS packages themselves have become easier to use for the casual computer user. This recently acquired availability of easy-to-use, inexpensive computerized data base management utilities to the researcher is having a very beneficial effect on the manner in which research is conducted. The technical staff now has the ability to store, retrieve, and analyze data in ways which would not have been practical or even possible before, and all without the necessity for, and the constraints connected with, the competition for the scarce resources of systems personnel.

The nature and scope of these technical applications of DBMS covers a wide range. This paper will attempt to give an

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Table 1—Patent Disclosure Tracking Data Base

Patent Description	Activity
Docket number	Docket number
Title	Activity code
Inventor	Country
Attorney	Date
Keywords	Comment
Serial number	
Patent number	

overview of several applications in the areas of technical administration, information retrieval, laboratory, and "personal" data bases. The intent is not to provide technical detail about any particular application, but to provide a base of ideas which may benefit other researchers in their information handling applications.

With the exception of the Project Activity Monitoring System (PAMS) which was developed on an IBM system under the CMS operating system using the FOCUS* data base package, all of the applications discussed were developed and operate on a Digital PDP11/44 minicomputer running the RSX11M+ operating system using DATATRIEVE† as the information retrieval package. While DATATRIEVE is not as easy for the novice or casual user to use for small applications as are some other packages now available, we have been quite successful with it in our research center.

In practice, these technical details of implementation are of the least importance to the user. A multitude of packages are now available for a wide range of computer systems and the selection of a DBMS for a particular application should be based mainly on the criteria of ease of use and the features required for the particular application. Consideration must also be made of the operating speed, both of the DBMS package and of the computer and its storage system, particularly in the case where large amounts of data must be stored and searched.

Administrative Applications

PAMS was developed to give technical managers accurate and timely information about research project time charges. Research projects are coded by technology, market, principal researcher, technical manager responsible, funding entity, etc. Each department's manpower budget forecast is stored for comparison to actual time charges. Project time charges are entered from the technical staff's weekly time sheets. Time may be charged to valid technical projects or to "unrelated" categories such as vacation, illness, training, etc. Over 20 standard reports are generated monthly. On-line inquiries on the status of a particular employee or project can be made at any time. Special reports and inquiries can be obtained on request. The data may be searched by any of the coding fields and can be sorted and summarized as desired by the manager. This system has proven most valuable not as a financial tool for billing time charges but as a tool for technical management to better manage their projects.

The Patent Activity Data Base was developed to provide better tracking and follow-up of this critical activity. The course of a patent disclosure from the time it is first disclosed until a patent is issued or it is abandoned can be a complicated process stretched over a time period of several years. Monitoring the status of the patent disclosures of a large research organization over this period of time is a formidable task. The Patent Disclosure Tracking Data Base was developed to centralize the stored information on patent disclosures in a searchable and retrievable form. This data base consists of two data files illustrated in *Table* 1. The first is the Patent Description file and contains the relatively unchanging biographical information describing the disclosure. Included in this file are the docket number assigned to the disclosure at the time of its submission, the title, the author, the technology involved in the invention, a series of keywords, the U.S. Patent Office serial number assigned when the application is filed, the attorney assigned to the case, and the patent number when it is assigned.

The second file is the Activity file and it contains records of standard activities and their associated dates and comments. This information is cross-indexed to the first file by the docket number. The standard report contains all information and activities associated with each selected disclosure, sorted chronologically. Custom searches and reports are available on request. This system has made the monitoring of patent disclosures as they progress toward becoming issued patents a much more manageable process. In addition, historical trends of issued patents and abandoned or rejected applications can easily be studied.

Information Retrieval Applications

The product of a research organization is knowledge. The distilled and summarized form of this knowledge is in the form of research reports. A research organization must be able to search and access its research reports easily and efficiently. The Research Report Index Data Base was developed for this purpose. It consists of biographical information for each report such as authors, dates, project numbers, etc., and a carefully selected set of keywords describing the report. Valid keywords are maintained in a thesaurus data base to insure consistency in their selection and application. This data base may be searched on any logical combination of biography and keyword information. Another information retrieval application is the Laboratory Notebook Tracking Data Base. This data base simply allows the user to inquire as to which employee a given laboratory notebook has been assigned, or to inquire which notebooks have been assigned to a given employee.

In addition to those information data bases developed within the research organization, a number of commercial data base systems are now available. Some examples of these commercial data bases and the types of information available are shown in *Table* 2. Additional commercial databases with information about a range of technical and business topics are also available.

Laboratory

A major application of data base in our laboratories is in the tracking of coatings test exposure data. The two types of exposure records currently implemented are for exterior hardboard siding coatings and for coil coatings. While these two classes of substrates and the coatings used for them are quite different, the basic structure of the data and reporting requirements are not. There are three general types of data contained in three data files. These are illustrated for the exterior hardboard exposure system in *Table* 3.

The first file contains the information about the substrate. This includes an identification number for the panel, the date, the location and type of exposure to which the panel was subjected, the manufacturer of the substrate, the trade name, and the results of a series of standard tests to evaluate the properties of the substrate. This information allows correlations to be

Table 2—Commercial Data Bases

Name	Contents
DIALOG	Technical literature Business information Patents
National Library of Medicine	Toxicity data
CAS on-line	Chemical compounds
TECHNOTEC	Technology available for licensing
SDC-ORBIT	World patent index

* FOCUS is a registered trademark of Information Builders.
† DATATRIEVE is a registered trademark of Digital Equipment Corporation.

Table 3—Hardboard Exposure Test Data Base

Board	Coating	Exposure
ID number	ID number	ID number
Date	Date	Date
Manufacturer	Manufacturer	12 tests
Location	Trade name	
Trade name	Formula number	
Four tests	Application method	
	Film thickness	

made between the performance of the coating and the particular properties of the substrate.

The second file contains information about the coating or coatings which have been applied to the substrate. The coatings data contains the description, manufacturer, lot number, color, and any other descriptive data for the coatings on each panel, and allows for multiple entries corresponding to multiple layers of primers and topcoats. In the case of coil coatings, various pre-treatment preparations may be included. This information facilitates the study of any possible interactions or relations between coats.

The third file contains the actual exposure test data. The exposure data is the most voluminous as the panel may be evaluated many times over a period of several years before it is retired. This is true both of accelerated and exterior exposure testing. Typical exposure test records contain ratings for overall appearance, color and gloss retention, chalking, cracking, blistering, etc. The coating and exposure records are cross-indexed to the substrate file by the panel identification number.

Another application of data base in the laboratory is in the tracking of analytical sample analysis requests. A fairly large number of Laboratory Information Management Systems (LIMS) are now commercially available. These generally include the logging and tracking of analysis requests as one of their functions. In the case of simple applications, it is often not necessary to purchase a comprehensive LIMS package designed for a large analytical lab if a DBMS is available. In our laboratories, two groups have implemented analytical sample logging and tracking systems in this manner. Information contained in these data bases includes the name and group of the person requesting the analysis, the dates on which the sample was submitted and reported, the charge number and the number of hours charged to the analysis, and a sample priority which is assigned at the time of sample submission and is automatically upgraded as a function of time if the request is still pending. Worksheets of pending sample requests sorted by priority are generated for each group performing the analyses. Reports of time charges and sample requests are generated to aid managers in manpower and resource management and planning.

Personal

A number of individuals have developed small data bases for their personal job use. An example of a data base of this type in the computer group is one containing the records of which employees within the research center have attended various computer training classes. This file is used to generate notices to managers when a series of classes is being planned so that they can review the training records for their groups and decide who needs to attend which class. This data base is then updated at the completion of each course.

Another personal data base in this department contains the acquisition dates and maintenance records of all computer terminals and printers in the research center. Since this equipment moves around the building, these records have made it much easier to decide if a particular unit is in warranty or is having a recurring service problem.

Conclusions

The benefits realized from the use of data base in research lie mainly in allowing the scientist to do a better job of research. Manpower reductions are usually not realized since time savings generally are reinvested. What is realized are gains in technical productivity and in the quality of work. In the case of the exposure test data bases, the development groups now are able to get the full value of their exposure data due to its accessibility. Duplication of effort which was required simply because data could not be located has been virtually eliminated. There has also been enhanced credibility with customers because data can be produced quickly and completely. In a chemical coatings business where other factors are often nearly equal, this translates to increased sales. In addition, products are being brought to market faster with increased confidence in warranty specifications, which again translates to increased sales.

In summary, database capability may be the single most valuable computer tool which can be provided to research today.

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OPEN FORUM

Quality Assurance in the U.K. Paint Industry: A Review and a Look at the Future

David W.N. Clayton
Crown Decorative Products Limited*

Following the re-awakening to quality awareness in the U.K. and the implications of British Standard 5750 (Quality Systems), the maintenance of a quality system in a major British paint manufacturer is described and the opportunities surveyed.

Introduction

I was fortunate enough to be born in Coronation year, not I hasten to add, of H.M. Queen Elizabeth II, but her father King George VI, in 1937. My memories of early childhood are of the Second World War years. Not of bombings and destruction—I was slightly removed from that—but of ration books, queues, shortages of new clothes, sweets, certain foods which were in short supply, and American servicemen in uniforms.

Most vividly, just after the War, I remember the huge joke that products from Japan were cheap and useless. Radios were a prime example; they never worked for very long. The quality was shoddy and the subject of great amusement.

The *American Paint and Coatings Journal* of May 19, 1986, reported that at the Southwestern Paint Convention held in Houston, Vic Figuerelli spoke on "The Philosophy and Total Management of Quality." He said, "To understand why quality is now being emphasized, you must look back 40 years, when the Japanese and German economies were devastated. They had poor quality products and they knew it. Japan began to learn quality from top to bottom." I recommend that article, entitled "A Road Map to Quality," to you.

Today, Japan is a world leader in many fields—radio, television and other electronic equipment, cameras, optics, cars, shipping, etc.—and has emerged into an efficient, major industrialized nation which is recognized, even envied, world-wide for the quality of its products. From the devastation and ashes of that sad period in world history, with the help of foreign aid (particularly American), and in the field of quality from such well-renowned figures as Deming and Juran, the way upward and forward was via the concept and application of quality policies so much so, that in 40 years, Japan has outstripped other nations whose attitudes to quality were traditional and even complacent.

Definitions of Quality

In the U.K., since entering the European Economic Community, we have gone partially metric. Beer and milk are still sold in pints and potatoes in pounds; but in industry we are into litres and kilos. My wife and I talk in inches, yards, and miles; our teenage daughter in centimetres, metres, and kilometres. Each of us understands the units—they are standardized, easily measured, and can be referred to a national or international standard. But what of quality? Is this readily understood, easily measured, or dictated by standards?

Unfortunately no! It is a perception as seen by supplier and customer. John Guaspari wrote a modern fable about quality which he entitled "I know it when I see it."

Quality is about doing things right. It is the sum of a number of things—reliability, fitness for purpose, and everybody doing his/her own bit. It has been described as: "The totality of features and characteristics of a product or service that bear on its ability to satisfy a given need." Essentially it is meeting customers' needs and expectations.

Quality Control has been defined as "a system for programming and coordinating the efforts of the various groups of an organization to maintain or improve quality on an economic level."

The significant portion of this definition is "the efforts of the various groups of an organization." This will come as a shock to some people in the paint industry, that quality and quality control have anything to do with any other part of the organization other than the quality function and the product control area. It is frequently as-

Presented on behalf of the Oil & Colour Chemists' Association at the 64th Annual Meeting of the Federation of Societies for Coatings Technology, in Atlanta, GA, on November 7, 1986.

*Paint Div., P.O. Box 37, Crown House, Hollins Rd., Darwen, Lancashire BB3 OBG, England.

sumed that quality is an ingredient which is stirred in at the very end of the manufacturing process, or, if a product when tested does not meet the required parameters, a quality wand is waved magically to make it acceptable. Quality is everybody's business.

If we do not plan for quality in our sales, marketing, and purchasing functions, or formulate and process the product correctly, put in the necessary checks, and ensure adequate training of staff, we are going to lose out to the competition who do.

early 1990's. In 1975, a group of some 20 people, mainly representing the engineering industry, met to produce BS 5750—Quality Systems. No chemists were involved as it was considered unlikely the chemical industry might ever need a regulatory approach to quality. In 1979, BS 5750 was published as parts 1, 2, and 3. Part 1 covers specification for design, manufacture, and installation. Part 2 covers specification for manufacture and installation. Part 3 covers specification for final inspection and test. Parts 4, 5, and 6 followed two years later as guidelines for parts 1, 2, and 3, respectively. On publication, it made very little impact and was obviously very engineering-biased. In 1982, the British government launched the National Quality Campaign. Organized by the Department of Trade and Industry, it is said the directive came from No. 10 Downing Street, the Prime Minister's office. From then on, BS 5750 has gained increasing impetus.

"Quality assurance. . .is a continuing assessment by audit and corrective action to ensure that agreed procedures for control are working."

In an article "Southerners Hear Call for Quality" in the May 12, 1986 issue of the *American Paint and Coatings Journal*, John A. Gordon, Director of the Center for Coatings Technology at Eastern Michigan University, gave a warning that the paint industry's survival depends on devotion to quality. He was further quoted as saying, "Given the present tendency to litigation in America today, we are operating in a climate that won't tolerate shoddy quality." He pointed to the U.S. automotive industry for "letting quality go down the tube," and, he said, "The Japanese and Koreans have come in and taken over, using quality as a standard."

He maintained that the role in quality assurance must be played by everyone in the plant. "Support must come right from the top. Everyone must discipline himself, with an understanding that, if I don't do my job, no one else will."

Quality assurance can be defined as "a system of activities whose purpose is to provide assurance and show evidence that the overall quality control job is in fact being done effectively." In other words, it is a continuing assessment by audit and corrective action to ensure that agreed procedures for control are working.

In the U.K., there is an ever-increasing number of local authorities, purchasing organizations, architects, contractors, specifiers, and individual companies who are insisting on supply from firms who are registered to British Standard 5750 (Quality Systems), who have given evidence that they have the controls to produce to a consistent level of quality.

Let us now look at this standard which is likely to develop into an ISO (International Standards Organisation) standard by the

Quality Assurance Procedures

But what does BS 5750 say? Basically this. No matter what the business, if you install a system of control, build quality procedures into all aspects of the business from sales, marketing, and purchasing through R&D to production and service, the product will be consistent and reliable. To comply with BS 5750, it is essential to develop a Quality Manual, act upon its contents, review and revise, and record actions taken. Of the three parts to BS 5750, part 2 is the preferred option of most companies unless they have major design aspects to the business. Concentrating on part 2, there are 17 basic requirements which need to be documented, and to which one should ask and answer the four questions:

Who is responsible?
When should it happen?
Where should it take place?
How is it carried out?

The answer to this last question may be detailed in subsidiary volumes to the Quality Manual which stipulates quality policy. Let us look at the 17 basic requirements.

(1) *Produce a documented quality system:* Make it as simple as possible. Do not set up procedures which are idealistic and difficult to achieve in practice. Why a Quality Manual? It insures against memory failures and provides known reference points. It insures against random, inadequately studied changes and provides formal update procedures. It insures against poor communication and provides a wide, known circulation. It insures against unauthorized changes and provides clear authority. It insures against effects of personnel changeover and provides convenient training material. Other advantages are that it gives a sense of law and order (it is backed from the top); it converts solved problems into recorded knowledge so as to avoid meeting and solving the same problem repeatedly; it coordinates interdepartmental action; it optimizes company, rather than departmental performance; and it provides a basis for audit of performance and practices.

There are, of course, drawbacks in operating Quality Assurance Manuals. They evolve obsolescent procedures, they do not cater for the unusual situation, and they can breed a bureaucratic, unimaginative "slavery" to procedure. But in the main, the advantages far outweigh the disadvantages.

(2) *Chart the organization for control:* Define who is responsible for implementation of the various aspects of the procedures. What is the line of authority. Indicate who the representative is who has overall control—a Quality Director or Quality Assurance Manager.

(3) *Audit and review:* After establishing the quality policy, this is the next most important aspect. Management must carry out periodic, regular reviews to ensure the system is effective. Deficiencies in the operation of the system must be recorded along with suggested corrective action. This action must be carried through.

(4) *Records:* It is necessary to provide for the documentation of inspection and test results, to provide evidence of the essential quality assurance activities. Procedures are needed for ensuring the currency, completeness, and accuracy records. "Is the most up-to-date specification being used?" and "who has the copies?" are typical analytical questions when reviewing the system.

(5) *Control of test measuring equipment (calibration):* Documented procedures are required to periodically ensure that test equipment used in quality control areas are examined against a calibration method and are recorded (and tagged) as to their status.

(6) *Control of purchased materials:* Establish methods to ensure incoming raw materials conform to the agreed specification. Draw up and document a check list to

use in vendor appraisal. Only recently, one of our suppliers was unable to meet our delivery requirements and he obtained a supply elsewhere. Not only was it not in specification but the replacement was heavily contaminated. When we went to see our original supplier about the problem, he had the most sophisticated of control systems, well-documented, computerized, and backed-up by excellent staff and modern technical equipment. What he didn't have was a vendor surveillance scheme. This had let him down and he quickly introduced one. Some materials will have been purchased for years from the same supplier without variation or cause for complaint. On this documented historical evidence little or no testing may be carried out.

(7) *Purchasing date:* What needs to be agreed with the supplier? Is he in possession of your specification or you of his? Are you both testing to the same parameters or using like equipment? Is the same method being used? Has the correct information been indicated on the purchase order form, or does it simply state "same as last time?"

(8) *In-process inspection:* Depending on the sophistication of the process, this does not always apply. Where it does, the four rules of who, when, where, and how apply. Some years ago, when monitoring the manufacture of 10-ton kettles of alkyds, I would take periodic samples to test for the miscibility of the monoglyceride, acid value, viscosity, color, and clarity as the reaction proceeded. In paint production, dispersion and color development need to be monitored.

(9) *Operating instructions:* Operating instructions for the process need to be clearly defined and documented. Their appearance on the batch process card and in the operator training manual needs to be legislated for.

(10) *Corrective action:* Devise methods for analyzing objective evidence and preventing any faults from recurring. Identify trends in a disciplined and organized manner. Effect controls to ensure corrective action is followed through.

(11) *Purchaser supplied material:* Not a very common practice in our industry, but this does happen. We ourselves no longer make lead based primers, but purchase them from an outside source. How are they to be assessed? Indicate identification and storage requirements, notification procedures in the event of substandard deliveries, and vendor approval activities.

(12) *Finished product inspection:* Draw up test methods, specifications to be met, actions to be taken, approval procedures, and routes of authorization.

(13) *Sampling procedures:* These are required both for incoming raw materials and finished goods.

(14) *Control of non-conforming materials:* Requires documented procedures for isolating non-conforming materials. The paint industry here has the advantage over the engineering industry. Quite often non-conforming materials can be blended off in a controlled and disciplined manner. You can't blend off non-conforming nuts and bolts. Agree and document who can authorize action on non-conforming materials.

(15) *Inspection status:* Identify whether materials are under testing, approved, or rejected. It isn't necessary to go to elaborate lengths. Placement in a certain tank will suffice to indicate the material is satisfactory for use. Some interim status may be required such as "must be used at the discretion of..." Status identity can be logged on a computer along with the materials storage designation. A simple card system or sticker label system can be employed or even a combination of systems. In my company all of these methods are employed plus a "lollipop" system of black for under testing, green for approved, and red for rejected.

(16) *Protection and preservation of product quality:* Detail control procedures for the identification, handling, and storage of materials from time of receipt through manufacturing to delivery. For instance, there is no point going to great lengths to purchase good clean material and then storing it in dirty tanks or filling into dirty packages. It would be foolish to pour a range of colors through the same pipeline unless there was an adequate flushing procedure to avert contamination.

And finally...

(17) *Training:* Define how much is needed, by whom, and record.

Each procedure should be drawn up in consultation with those who will operate them. This will ensure maximum commitment from those involved in agreeing what is workable and will have been drafted by the real experts—those doing the job.

Once all this has been agreed, fully documented, and submitted to the British Standards Institute or other approved certificating body, a team of assessors will descend upon your plant and inspect rigorously to substantiate or refute that all the claimed controls are effective in permitting the manufacture of a consistent product pitched at an agreed grade of quality. If certificated, regular surveillance checks will be carried out (at a cost) to ensure compliance and maintenance.

Results

So what does all this gain us? First, it improves our approach to quality and the effectiveness of the business. Second, it enables us, through recognition of the approval, to compete in the market place. Acceptability and the requirement of BS 5750 sets up a chain reaction. Take the example of a housing contractor who is required by the planners or architects to be in compliance with BS 5750 and to ensure that his materials are obtained from firms likewise approved. His bricks, plaster, timber, tiles fittings, paint, etc. are required to be bought from approved suppliers. Already in the U.K., we are seeing evidence of this as BS 5750 gains impetus.

"Western nations are re-awakening to the needs for an improved approach to quality effectiveness through quality assurance."

Crown suppliers (a government agency that spends in excess of £400 million per year) were represented at a quality seminar in June 1986 and their spokesman, amongst other things, said...."BS 5750 carries great weight with us...." The lead article in *Plastic and Rubber Weekly* of September 20, 1986, opens by saying "suppliers of plastics and rubber components are being presented with tight deadlines by their customers to get registered to the national quality standard BS 5750." At a May conference on quality held in the U.K., a Japanese delegate, comparing his own country's approach to quality with that of Western nations, summed it up by saying "We practice what you preach."

Western nations are re-awakening to the needs for an improved approach to quality effectiveness through quality assurance. May their drive forward be hastened by the old adage: "The bitterness of poor quality remains long after the sweetness of low price."

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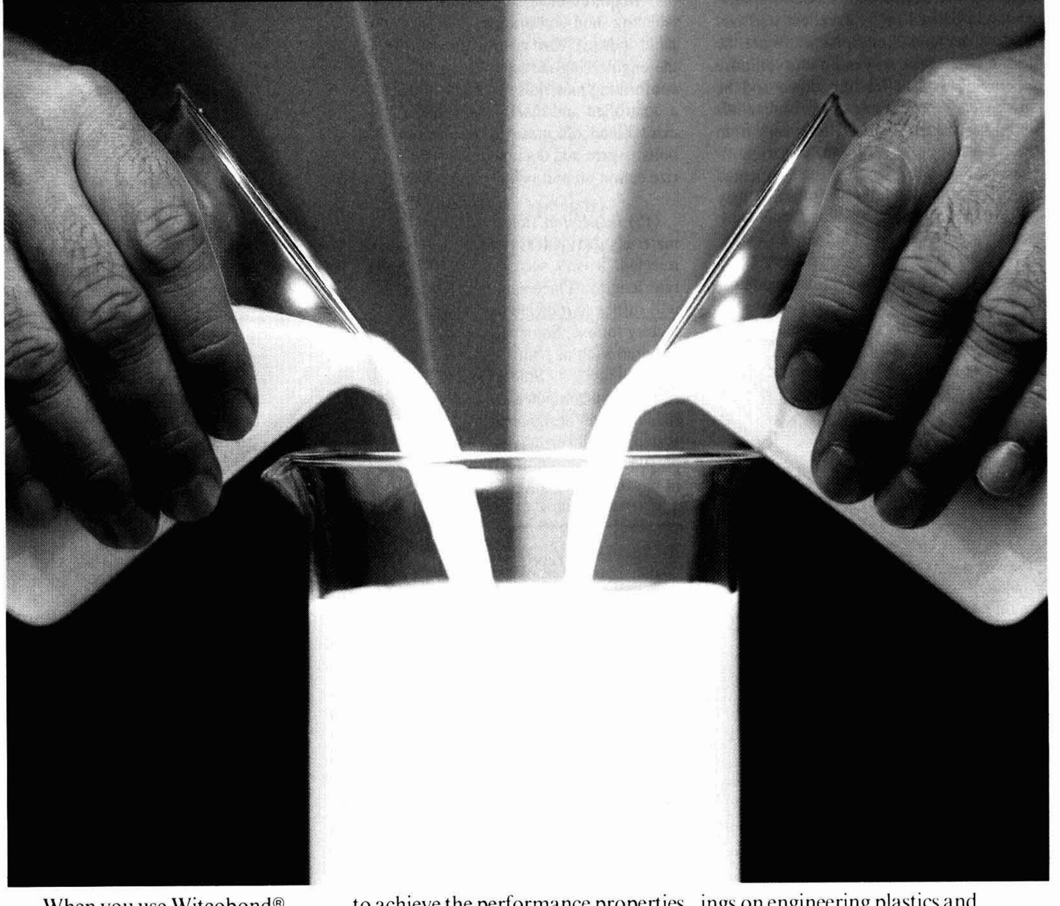

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Society Meetings

CDIC .... JAN.

"Horizontal Mills"

Paul Cory, of Opex Minerals, was the meeting's guest speaker. Mr. Cory, a gem cutter and wholesaler, presented a talk on "HOW COLOR IS CREATED IN GEMSTONES."

The technical speaker was Armin Szatmary, of Premier Mill Corp., New York, NY. Mr. Szatmary discussed "WHY USE HORIZONTAL MILLS?"

The two main reasons to use horizontal mills, according to Mr. Szatmary, are to increase productivity and reduce operating costs. A horizontal mill is essentially a sandmill with a cover screen and a sealed chamber so that it may be operated under pressure.

The speaker said that three of the seven major components of the mill, the agitators, the media retaining device, and the shaft seal are critical to operating efficiency. Choosing the best critical component for a particular application allows for maximum throughput.

Agitators come in various shapes and sizes. The configuration and spacing produces a specific flow pattern within the grinding chamber.

The speaker said that each type of media retaining device—fixed slotted screen, slot gap separator, rotating screen, and cylindrical screen—has advantages and disadvantages in cost, ease of maintenance, pressure release, and tendency to plug. The retaining device keeps the grinding media inside the chamber during the discharge of the product. But, Mr. Szatmary told the audience, it should be suited to the size of media.

The amount of pressure in the chamber depends on the shaft seal. There are four choices of shaft seals: lip seal; single mechanical seal; double mechanical seal; and pressurized mechanical seal. They vary in cost, complexity, and ease of maintenance.

One main advantage of horizontal mills is the ability to use more grinding media which increases productivity. They require lower operating costs, less space, less grinding media, less cleaning solvent, and are easier to start, work on, and clean. They also do not require constant operator attention and may be run in a series off a common feed pump.

In conclusion, Mr. Szatmary said that horizontal mills are highly recommended for dispersing pigments, producing maximum color development, gloss, and transparency.

CAROLYN L. TULLY, *Secretary*

CHICAGO................ JAN.

"25-Year Club"

The Society is seeking nominees for their 25-Year Club. Members who have belonged to the Chicago Society, or various other related societies, continuously, for 25 years, are eligible.

EVANS ANGELOS, *Secretary*

CLEVELAND .... NOV.

"Foams and Anti-Foams"

The evening's speaker was Robert E. Patterson, of the PQ Corp. Dr. Patterson talk was entitled "FOAMS AND ANTI-FOAMS."

Dr. Patterson used slides to demonstrate the formation of foam in solutions. He explained that more foam problems were associated with manufacturing coatings, but application problems were the ones about which the most complaints were received.

The speaker went on to explain the use of anti-foams in manufacturing water-based paints and non-aqueous coatings.

Dr. Patterson showed the thermodynamics of foam stability and evaluated anti-foam formulas. Evaluation can be done using a paint shaker, aging, draw-downs, and roll-outs. There is no best way, Dr. Patterson cautioned, so more than one method should be used.

In conclusion, the speaker explained the composition of anti-foams.

R. EDWARD BISH, *Secretary*

DALLAS................. JAN.

"Porosity of Latex Particles"

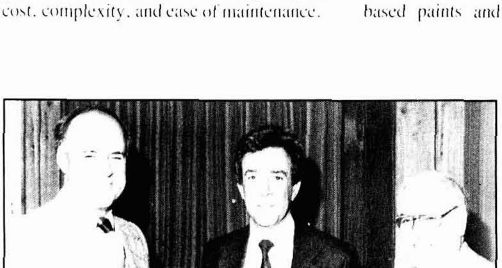
The technical presentation was given by Hanu Batchu, of Coulter Electronics, Inc., Richardson, TX. He spoke on "THE DETERMINATION OF THE PERCENTAGE OF POROSITY OF LATEX PARTICLES USING COULTER'S MULTISIZER."

Mr. Batchu began his presentation reviewing the methods of obtaining porosity or percent vesiculation. They are: optical scanning, gas absorption, mercury intrusion, and the Coulter Principle. He then discussed the various limitations of the first three methods.

The speaker explained that Coulter equipment is designed to provide rapid, reliable, and accurate readings through large particle ranges. However, the first and second Coulter counter systems had their limitations. This led to the development of the Coulter Multisizer which is a combination of the best attributes of the two systems. Mr. Batchu gave a detailed presentation of the Multisizer's applications, operations, and outputs.

In conclusion, the speaker said the Coulter Multisizer is user-friendly, has a wide particle size range, poses no health hazards, is lower in cost than the Mercury method, and is more accurate than other available methods.

BRUCE W. ALVIN, *Secretary*



IN ATTENDANCE AT THE CDIC SOCIETY JANUARY MEETING were (left to right): Society Education Committee Chairman James E. Flanagan, technical speaker Armin Szatmary, and Society Representative Lloyd R. Reindl

CDIC SOCIETY PRESIDENT Joseph W. Stout and Educational Speaker Paul Cory

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Martin's Market Square, Towson, MD). HELEN KEEGAN, Valspar Corp., 1401 Severn St., Baltimore, MD 21230. Virginia Section—Fourth Wednesday, Ramada Inn-East, Williamsburg, VA.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). D.M. HEATH, Holden Surface Ctgs. Ltd., Bordesley Green Rd., Birmingham B9 4TQ England.

CHICAGO (First Monday—meetings alternate between Como Inn in Chicago and Sharko's West in Villa Park). EVANS ANGELOS, Kraft Chemical Co., 1975 N. Hawthorne Ave., Melrose Park, IL 60160.

CDIC (Second Monday—Sept., Jan., Apr., June in Columbus; Oct., Dec., Mar., May in Cincinnati; and Nov., Feb. in Dayton). CAROLYN TULLY, Sun Chemical Corp., 4526 Chickering Ave., Cincinnati, OH 45232.

CLEVELAND (Third Tuesday—meeting sites vary). R. EDWARD BISH, Jamestown Paint & Varnish Co., 108 Main St., Jamestown, PA 16134.

DALLAS (Thursday following second Wednesday—Executive Inn. Near Love-field Airport). BRUCE ALVIN, DeSoto, Inc., P.O. Box 461268, Garland, TX 75046.

DETROIT (Fourth Tuesday—meeting sites vary). JOANNE CEDERNA, BASF Inmont Corp., 26701 Telegraph Rd., Southfield, MI 48086.

GOLDEN GATE (Monday before third Wednesday—Alternate between Francesco's in Oakland, CA and Leaning Tower Restaurant in S. San Francisco). ERNEST SOLDAVINI, Nuodex Huls, 5555 Sunol Blvd., Pleasanton, CA 94566.

HOUSTON (Second Wednesday—Look's Sir-Loin Inn, Houston, TX). JAMES TUSING, PPG Industries, Inc., P.O. Box 1329, Houston, TX 77251.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). ROGER HAINES, Tnemec Co., Inc., P.O. 1749, Kansas City, MO 64141.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). PARKER PACE, Behr Process Corp., P.O. Box 1287, Santa Ana, CA 92702.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). LOUIS HOLZKNECHT, Devoe Marine Coatings, 1437 Portland Ave., Louisville, KY 40203.

MEXICO (Fourth Thursday—meeting sites vary).

MONTREAL (First Wednesday—Bill Wong's Restaurant). R. FERRIS, Canbro Ltd., 29 E. Park St., Valleyfield, Que., Canada J6S 1P8.

NEW ENGLAND (Third Thursday—LeChateau Restaurant, Waltham, MA). ROGER WOODHULL, California Products Corp., P.O. Box 569, Cambridge, MA 02139.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). DAVID PENICHTER, D.H. Litter Co., Inc., 116 E. 16th St., New York, NY 10003.

NORTHWESTERN (Tuesday after first Monday—Jax Cafe, Minneapolis, MN). RICHARD KARLSTAD, Ceramic Industrial Coatings, 325 Hwy. #52-South, Osseo, MN 55396. WINNIPEG SECTION (Third Tuesday, Marigold Restaurant)—NEIL WEBB, Phillips Paint Products Ltd., 95 Paquin Rd., Winnipeg, MB, Canada R2J 3V9.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). JOHN DALLER, McCloskey Corp., 4155 N.W. Yeon, Portland, OR 97210.

PHILADELPHIA (Second Thursday—Williamson's, GSB Bldg., Philadelphia, PA). LAWRENCE J. KELLY, Peltz-Rowley Chemicals, 5700 Tacony St., Philadelphia, PA 19135.

PIEDMONT (Third Wednesday—Howard Johnson's, Brentwood Exit of I-85, High Point, NC). BARRY YORK, Reliance Universal, Inc., P.O. Box 2124, High Point, NC 27261.

PITTSBURGH (First Monday—Montemurro's, Sharpsburg, PA). RICHARD G. MARCI, Royston Laboratories, 128 First St., Pittsburgh, PA 15238.

ROCKY MOUNTAIN (Monday following first Wednesday—Bernard's Arvada, CO). JEFFREY B. JOHNSON, Sashco, Inc., 1395 S. Acoma, Denver, CO 80223.

ST. LOUIS (Third Tuesday—Salad Bowl). ROBERT L. WAGNON, Mozel Chemical Products 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; Miami Section—Tuesday prior to Central Florida Section—R. SCOTT MCKENZIE, Southern Coatings & Chemicals, P.O. Box 2688, Sumter, SC 29150.

TORONTO (Second Monday—Cambridge Motor Hotel). LARRY HAM, Stochem Inc., 5200 Dixie Rd., Suite 201, Mississauga, Ont., Canada L4W 1E4.

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

GOLDEN GATE .... JAN.

"Filtration of Industrial Coatings"

Society President Patricia Shaw, of Davlin Coatings Inc., presented 25-Year pins to the following: Clyde Burger and George Hunt, of Kelly-Moore Paint Co.; Mark R. Donahoo, of Pride Paint Mfg. Co.; Lowell Cummings, of Lowell Cummings Consultants; Harold R. Harlan, Jr., of Harlan Associates, Inc.; Paul LaLiberte, of Universe Paint Co.; Robert LaPachet, of Polyvinyl Chemical Industries; John T. March, of Intercoastal; Leon Persson, of Harrisons & Crosfield Pacific; Leo Schinasi, of Nuodex, Inc.; and A.H. Thompson, Jr., of A.H. Thompson Co.

Carney Likens, of Commercial Filters, Lebanon, IN, was the guest speaker. Mr. Likens, a member of the CDIC Society, discussed "EFFECTIVE FILTRATION OF INDUSTRIAL COATINGS."

Mr. Liken's emphasized how to save the user time, money, and labor through better selection and use of filtration media/equipment. His presentation centered on the resin-bonded type cartridges which are the most effective and compatible with the broad range of industrial coatings.

Proper filtration and cartridge selection upgrades quality control and results in the removal of unsuitable particles, faster packaging, minimum rework, cost efficiency, equipment conservation, day-to-day consistency, and customer acceptance.

According to Mr. Likens, cartridges may look alike, but they perform differently. He also discussed the advantages of long fiber, unidirectional short fiber, and unidirectional laminated long fiber cartridges.

In conclusion, the speaker offered practical tips for improving filtration related to gel removal, vessel selection, and cartridge selection. He said that suppliers test and rate cartridges differently, making trial and error the best course for selecting a cartridge for a specific application.

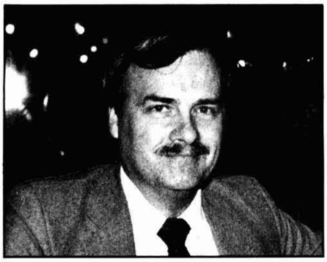
ERNEST SOLDAVINI, *Secretary*

HOUSTON .... DEC.

"Corrosion Inhibitive Pigments"

The technical presentation was given by M.C. McLaurin, of Buckman Laboratories, Inc., Memphis, TN. Mr. McLaurin, a member of the Southern Society, spoke on the topic of "CORROSION AND ITS CONTROL WITH NON-LEAD/NON-CHROMATE CORROSION INHIBITIVE PIGMENTS."

Mr. McLaurin's presentation began with a discussion on the need for non-lead/non-chromate corrosion inhibitive pigments in coatings for metal substrates. A brief review of the electrochemical corrosion process was followed by an introduction to the



GUEST SPEAKER Carney Likens addressed the Los Angeles Society at its January meeting

modes of action of various corrosion inhibitive pigments including: anodic and cathodic mechanisms; barrier coatings; and active and passive corrosion inhibitors.

The results of the salt fog study compared the performance of non-lead/non-chromate inhibitors to zinc chromate and basic lead silico chromate in long oil alkyd primers Mr. McLaurin stated. In conclusion, a number of formulating hints to aid the formulator in the successful development of coatings containing non-lead/non-chromate corrosion inhibitive pigments were discussed.

James E. Tusing, *Secretary*

KANSAS CITY............. JAN.

"Rheological Additives"

Society Vice-President Jerry P. Hefling, of Loctite Corp., explained the "official" response from OSHA on the questions concerning HMIS labeling of inplant materials and small quantity, quality control type, laboratory samples taken from raw materials or finished goods.

Warren O. Manley, of Cook Paint & Varnish Co., noted that on July 18, 1986, OSHA sent out a directive to all compliance officers stating that HMIS may be used as long as it is a part of an integrated system of hazard communication within the plant.

A presentation was given by Dwaine Siptak, of E.C.C. America, Inc., Gonzales, TX. Mr. Siptak, a member of the Houston Society, spoke on "Rheological Additives for Non-Aqueous Coatings."

Mr. Siptak briefly detailed the history of organo-clay rheology modifiers. He touched on the basic types available and explained their use and function in coatings systems and the process methods by which the polar activated and "preactivated" clays are produced. He discussed the advantages and disadvantages of using organo-clays and addressed the industry's plan for future development of a universal bentonite.

Roger E. Haines, *Secretary*

LOS ANGELES............ JAN.

"Filtration of Industrial Coatings"

The evening's speaker was Carney Likens, of Commercial Filters, Lebanon, IN. The CDIC Society member gave a presentation on "Effective Filtration of Industrial Coatings."

Q. What is the typical life of a particle filter and what is the proper disposal of these filters?

A. The key thing is that the process is the most variable thing. It can vary from day to day. We test our products versus other products. We can look at our test data and choose one that will last as long. Using AC-coarse test dust or AC-fine test dust in water at 3.5 gallons per minute; you're looking at anywhere from ¼ to ½ pound of contaminant.

Proper disposal is an area that's getting a lot of attention. I'll relate one incident that I've been working with. Sherwin-Williams Co. in Richmond, KY, has made a commitment to their community that they will have zero hazardous waste disposal. What they're doing with our paper cartridges is flushing it with solvent, drying it out, shredding it, and compacting it. This sounds like a lot to do and costly. Sherwin-Williams Co. uses the pigment recovered in paint.

Parker Pace, *Secretary*

NORTHWESTERN......... JAN.

"Batch Plant Control"

There was a moment of silence in memory of Fred Strom, founder of Ti Kromatic Paints and Past-President of the Northwestern Society, who died on December 28, 1986. The Society is donating $50 to the Alzheimer Treatment & Research Center in his name.

Society Representative Richard L. Fricker, of Valspar Corp., brought Society members up-to-date on the new regulations in California.

The speaker was Bob Jones, of Monsanto Co., who spoke on "Quality Effects of Batch Plant Control with Provox®."

Mr. Jones explained that Provox is the tradename of a computerized control system sold by Fisher, a division of Monsanto. Monsanto has used the system to upgrade the uniformity of their resins and monitor several reactors. A reduction in manpower and off-grade resin, and improved uniformity justified the cost of the system.

Installation of the Provox system reduced off-grade material by 90% and improved the uniformity, he said. Viscosity standard deviation went from 0.095 to 0.067 and standard deviation of hydrocarbon tolerance was reduced from 0.65 to 0.34.

In conclusion, Mr. Jones stated that uniformity between plants was also improved.

Richard Karlstad, *Secretary*

PHILADELPHIA........... JAN.

"New Tax Laws"

The guest speaker was Robert Collier of the Internal Revenue Service. He spoke on "New Tax Laws and How They Pertain to Individuals and Corporations."

Lawrence J. Kelly, *Secretary*

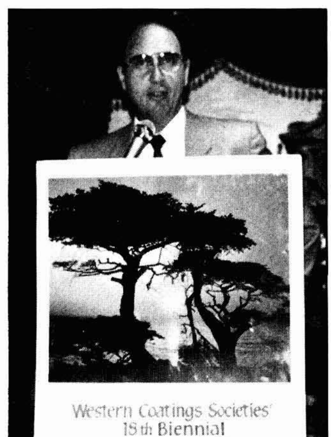
PIEDMONT............... DEC.

"Asbestos"

The first speaker was Carl Willis, Director of Public Works, High Point, NC. Mr. Willis spoke about a project that High Point was working on for extracting methane gas from waste. Within five years, enough power will have been obtained to totally operate its $30 million waste/water treatment plant.

High Point has put another project to use, on a small scale, which incorporates the mixing of a calcium chloride product with asphalt to eliminate ice and snow from sticking to the surface. His city is the first in the southeastern U.S. to incorporate this product.

Mr. Willis concluded his talk emphasizing the importance of "communication" in government, and monitoring cost control in government.



SOCIETY PRESIDENT Henry J. Kirsch conducted the business portion of the Los Angeles Society January meeting

The second speaker was John Kelse, of R.T. Vanderbilt Co., Savannah, GA. Mr. Kelse talk was "DOES NEW YORK STATE TALC CONTAIN ASBESTOS?"

The speaker addressed the definition of asbestos and how it determines what pigments can be used according to OSHA. Mr. Kelse drew the line between asbestos and its non-asbestos counterpart, silicate minerals, including: crystolite, entigonite, anosite, anthophylite, trimolity, and atinolite. He pointed out the main problems in the rules set by OSHA in determining which minerals are asbestos and which are non-asbestos. In conclusion, he stated that the problem had not yet been solved.

BARRY F. YORK, *Secretary*

PIEDMONT .... JAN.

"Formulation with Polyetheramines"

Art Benton, President of Materials Marketing Associates, sent a letter to the Society expressing his congratulations on their winning the MMA Award of $350.

James M. Bohannon, of Valspar Corp., is the Society's new Education Committee Chairman. He will be heading up the summer employment program and is in the process of getting together a seminar for the spring.

Dr. M.D. Hurwitz, Educator, UNC-Greensboro, discussed options the Society may elect to take in terms of continuing education. An example was another polymers course or other courses for education.

The technical speaker was W.C. Crawford, of Specialty Chemicals, Texaco Chemical Co., Bel Air, TX. His presentation was "FORMULATION WITH POLYETHERAMINES."

Dr. Crawford began his talk reviewing the products he works with at Texaco, including: Jeffamine products, Jeffonamine products, urethane polyols, urethane catalysts, carbonates, and ethyleneamines-propylamine derivatives. He detailed products of his company which are of interest to the coatings industry, highlighting polyetheramines (Jeffamine products). He also reviewed amine curing agents in relation to use with various products and curing, and mentioned accelerator products.

In conclusion, Dr. Crawford stated the reasons that Jeffamine products are useful to the epoxy formulator.

BARRY F. YORK, *Secretary*

PITTSBURGH .... JAN.

"Leveling Agents"

Education Committee Chairman Donald Boyd, of PPG Industries, Inc., asked the Society for help in making contacts at small local colleges to award grant money for paint or polymer science projects. He also asked for help in contacting local high schools so that presentations can be made during career nights. Anyone who can provide assistance should contact either Donald Boyd or Clifford Schoff at PPG.

Society President Anthony J. Isacco, II, of Puritan Paint & Oil Co., brought up the question of changing the society meeting date. The officers are in favor of changing the date to the second Monday of the month. The by-laws must be checked before any dates are changed.

Kearan Moore, of Watson Standard Co., will become Chairman of the Society's Environmental Controls Committee.

Cleveland Society member Robert W. Vash, of Byk Chemie, U.S.A., Mantua, OH, was the evening's speaker. His talk was entitled "FLOW AND LEVELING AGENTS."

Mr. Vash said there are a number of products that influence flow and leveling. First and foremost are solvents. Two other methods of influencing flow and leveling are to make linear resins with tailor-made incompatibility or to use silicones made in a linear fashion.

Surface tension is one reason some of the more modern polymers exhibit flow and leveling problems. The solvents used with these polymers generally have a higher surface tension, while the polymers also have a high surface tension. For a coating to flow over a substrate, the coating material must have a lower surface tension than the substrate.

According to Mr. Vash, Byk Chemie investigated the surface tension phenomenon and found that a surface tension curve can better describe how a flow and leveling additive will work. Flow and leveling can be predicted to some extent by checking the surface tension curve for a specific system.

In conclusion, Mr. Vash discussed the three different silicone types that can be used to convert a pigment float to a flood. They are polydimethyl siloxanes, polymethyl phenyl siloxanes, and siloxane chains with pendant groups other than methyls or phenyls.

RICHARD MARCI, *Secretary*

WESTERN NEW YORK .... DEC.

"High Solids"

Treasurer Gerald F. Ivancic, of Pratt & Lambert, Inc., reported that a $100 scholarship fund donation had been received from Essex Specialty Products, Jamestown, NY.

Richard M. Benton, of NL Chemicals, Buffalo, NY, presented a talk on "CLOSING THE GAP WITH HIGH SOLIDS."

Mr. Benton discussed the formulation of high solids resins in bake and air-dry coatings that meet current EPA regulations. Attention was given to the difference between calculated and determined VOCs of bake systems and how VOC was related to transfer efficiency in spray applications and paint resistivity.

In conclusion, Mr. Benton presented data on new high solids resins and formulating techniques that meet upcoming lower VOC requirements in bake and air-dry applications.

MARKO K. MARKOFF, *Secretary*

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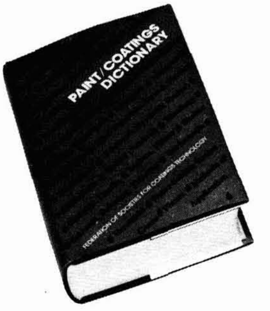

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Future Society Meetings

Cleveland

(Apr. 21)—"HIGH SOLIDS COATINGS"—S. Peter Pappas, North Dakota State University.

(May 19)—SPOUSES' NIGHT. "ART CONSERVATION AND AUTHENTICATION"—Fred Hollendoner.

Golden Gate

(May 18)—"ADVANTAGES OF PREDISPERSED POLYETHYLENES AND WAXES IN HIGH PERFORMANCE COATINGS"—Elio Cohen, Daniel Products Co.

Houston

(May 13-14)—SPRING TECHNICAL SYMPOSIUM. "WATER REDUCIBLE COATINGS"—Richard Johnson, Cargill, Inc.

Los Angeles

(May 13)—"ADVANTAGES OF PREDISPERSED POLYETHYLENES AND WAXES IN HIGH PERFORMANCE COATINGS"—Elio Cohen, Daniel Products Co.

New York

(May 12)—PAST-PRESIDENTS' NIGHT. PAVAC AWARDS PRESENTATION.

Northwestern

(May 5)—"COLOR SAMPLING FOR THE PAINT INDUSTRY"—Donald S. Woelfel, Colwell/General, Inc. and "PURCHASING"—Chuck Gallagher, Valspar Corp.

Pacific Northwest Portland, Seattle, and Vancouver Sections

(May 19-21)—"ADVANTAGES OF PREDISPERSED POLYETHYLENES AND WAXES IN HIGH PERFORMANCE COATINGS"—Elio Cohen, Daniel Products Co.

Philadelphia

(May 14)—"EPOXY MASTIC COATINGS"—Orville E. Brown, M.A. Bruder & Sons, Inc.

(June 5)—ANNUAL GOLF OUTING

Piedmont

(May 20)—"CURRENT DISPERSION MILLING METHOD"—Armin Szatmary, Premier Mill Corp.

(June 17)—"AN INTRODUCTION TO APPEARANCE ANALYSIS"—Richard W. Harold, Hunter Associates Laboratory, Inc.

Pittsburgh

(May 4)—"IN-STORE COMPUTER MATCHING"—Dennis Dempsey, Color Corp. of America.

Rocky Mountain

(May 11)—"ADVANTAGES OF PREDISPERSED POLYETHYLENES AND WAXES IN HIGH PERFORMANCE COATINGS"—Elio Cohen, Daniel Products Co.

St. Louis

(Apr. 21)—MANUFACTURING SEMINAR.

(May 19)—ELECTION OF OFFICERS.

(June 12, 13)—JOINT MEETING WITH KANSAS CITY SOCIETY.

Elections

BIRMINGHAM

Active

Owens, Ralph W.—E.M.S. Grilon (UK) Ltd., Stafford.
Potter, David J.—Holden Surface Coatings, Birmingham.

C-D-I-C

Active

Adkins, Don P.—Dayton Paint & Ctgs., Dayton, OH.
Blankenship, Jeffrey—Chemical Marketing Service, Cincinnati, OH.
Brakke, N. Bradford—Lilly Industrial Ctgs., Indianapolis, IN.
Cattell, Jeffrey M.—Hanna Chemical Ctgs., Columbus, OH.
Deutscher, Andrew K.—Hanna Chemical Ctgs., Columbus.
Koch, James R.—Ashland Chemical Co., Dublin, OH.
Krister, Charles L.—Dayton Paint & Ctgs., Dayton.
Mann, Richard E.—Yenkin-Majestic Paint Co., Columbus.
Maurer, Richard E.—Hamilton Fixture, Hamilton, OH.
Melnyk, Thomas J.—Lilly Industrial Ctgs., Indianapolis.
Pease, Elwood E.—Paint America Co., Dayton.
Price, Robert N.—Ashland Chemical Co., Columbus.
Reaver, Dale E.—Hanna Chemical Ctgs., Columbus.
Willhite, John A.—Hanna Chemical Ctgs., Columbus.

Associate

Guiducci, Denise K.—GAF Corp., Cincinnati, OH.
Gundlach, Eugene C.—Maroon Chemical Group, Cincinnati.
Jackson, Joseph—Maroon Chemical Group, Worthington, OH.
Moore, Paul H.—Morton Thiokol Inc., Cincinnati.
Schnieders, James J.—K.A. Pendleton Co., Inc., Cincinnati.

DALLAS

Active

Jones, Annette V.—Union Carbide Corp., Garland, TX.
Kessler, W.W.—Union Carbide Corp., Garland.
Schmidt, DeeAura L.—Union Carbide Corp., Garland.

HOUSTON

Active

Deutsch, Thomas E.—PPG Industries, Inc., Houston, TX.

Associate

Morton, Tamara L.—Pacific Anchor Chemical Corp., Houston, TX.

NEW ENGLAND

Active

Crall-Fallon, Karen R.—Sanncor Industries, Leominster, MA.
Crosby, John F.—Sterling-Clark Lurton, Malden, MA.
Hall, Richard K.—Technical Ctgs. Lab., Inc., Avon, CT.
Matroni, Gary M.—Whittaker Coatings, Chicopee, MA.
Michalides, Raskevas M.—Sanncor Industries, Leominster.
Monique, Mark A.—Sanncor Industries, Leominster.
Wheeler, Sandra J.—Whittaker Coatings, Chicopee.

Associate

Ferri, Robert J.—Day-Glo Color/Nalco, Cranston, RI.
Sheldon, Karen S.—Johnson Wax, Framingham, MA.
Stiff, Wendy L.—Color Corp. of America, Sicklerville, NJ.
Walsh, John J.—The Truesdale Co., Brighton, MA.

Educator/Student

Amrish, Dave—University of Lowell, Lowell, MA.
Elayaperumal, Piramiah—University of Lowell, Lowell.

NEW YORK

Active

Fischman, Bernard—Armstrong Paint, Brooklyn, NY.
Tracton, Arthur A.—Hempel Coatings Inc., Wallington, NJ.

Associate

Kenny, William L.—Metro Oil & Chemical Corp., Ridgefield, NJ.
Woodcock, David S.—Occidental Chemicals, Verona, NJ.

NORTHWESTERN

Active

Clark, Jerry W.—Valspar Corp., Minneapolis, MN.
Mulvany, Fredrick S.—Valspar Corp., Minneapolis.

Associate

Aamodt, Jan T.—Ashland Chemical Co., Blaine, MN.
Brown, Kevin B.—Worum Chemical Co., St. Paul, MN.
Fulton, Robert C.—Superwood Corp., Duluth, MN.

PIEDMONT

Active

David, Robert A.—Histrand Chemicals, Inc., Lenoir, NC.
Gilley, Thomas Lee—John Boyle & Co. Inc., Statesville, NC.
Olhoft, Gary V.—Union Carbide Corp., Cary, NC.
Say, Terry E.—Walsh Chemical Corp., Gastonia, NC.

Associate

Hickey, Peter A.—Dow Chemical USA, Charlotte, NC.
McDonald, Patrick J.—Reichhold Chemicals, Charlotte.

PITTSBURGH

Active

Frishof, Barry L.—Watson Standard Co., Pittsburgh, PA.
Gogal, William—Valspar Corp., Pittsburgh.
McCourt, Robert S.—Watson Standard Co., Pittsburgh.
Moore, Kearan A., Jr.—Watson Standard Co. Pittsburgh.
Reed, Dean O.—Watson Standard Co., Pittsburgh.
Scott, Michael A.—Watson Standard Co., Pittsburgh.
Zediak, Clinton S.—Watson Standard Co., Harwick, PA.

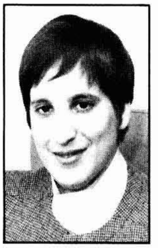
Associate

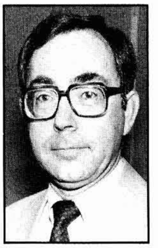
Wilson, James D.—CasChem Inc., Fairfield, OH.

AFFILIATED

Sy, Jerry Go—Globesco Inc., Quezon City, Philippines.


R.G. Spitzer


J. Yuster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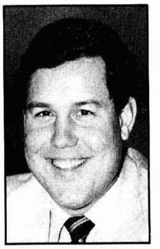

J.L. Hamner

Ronald G. Spitzer has been promoted to National Accounts Manager for Cosan Chemical Corp., Carlstadt, NJ. Mr. Spitzer, who joined Cosan in 1966, most recently served as Regional Sales Manager for the eastern and southwestern U.S. He is a member of the Baltimore, New York, and Southern Societies.

R.J. (Bob) Willis, a long-time leader and member of the Oil and Colour Chemists' Association Australia, retired in March. Mr. Willis was associated with Hardie Trading Limited and James Hardie Industries, Sydney, Australia, for many years.

PPG Industries, Inc., Pittsburgh, PA, announced that **Joseph Cafaro** and **Paritosh M. Chakrabarti** have been named Vice-Presidents in the Chemicals Group. Mr. Cafaro will be involved in chlor-alkali and derivatives, while Dr. Chakrabarti will work in research and development.

Also, **Howard I. Roe** has been named to the new post of General Manager, Surfactants, in the Chemical Group. He will have overall responsibility for PPG's surfactants businesses.

In addition, **Neil H. Frick** has been appointed Vice-President, Research and Development, for the Coatings and Resins Group. He will direct the group's technical efforts on a global basis.

The Research and Development Center, Coatings and Resins Division, Allison Park, PA, has announced the appointments of **Donald W. Boyd** to Senior Research Chemist and **Brij N. Sharma** to Senior Development Chemist. Dr. Boyd is a member of the Pittsburgh Society and currently serves as its Educational Committee Chairman. Mr. Sharma is also a member of the Pittsburgh Society.

Raymond E. Barnes has been named Quality Assurance Manager, Pigments, for the Color Division, Ferro Corp., Cleveland, OH. He will be responsible for quality assurance at Ferro pigment operations in Cleveland and Toccoa, GA.

In addition, **James R. Gettys** has been named General Manager, Pigments, for the Color Division. He will be responsible for manufacturing and marketing activities of pigment operations in Cleveland and Toccoa. Mr. Gettys previously served as General Manager for glass colors.

Jane Yuster has been named to the new position of Division Director for Biocides at Troy Chemical Corp., Newark, NJ. Miss Yuster is a member of the New York Society. Also named to a new post was **Robert T. Maher,** Division Director for Additives. They will be responsible for product development, manufacturing, and marketing.

In addition, **Edward J. Capasso** has been named Director of Environmental and Regulatory Affairs, assuming the former duties of Miss Yuster. He will handle supervision of regulatory compliance in labeling and safety recommendations and for products covered by local, state, and federal regulations.

Dave L. Peterson of Eiger Machinery, Inc., Bensenville, IL, has been appointed Vice-President, Sales and Marketing. Mr. Peterson has been with Eiger since 1983 and most recently served as National Sales Manager. He is a member of the Chicago Society.

Lee Bower has been named Business Manager, Epoxy Curing Agent Product Group, of Sylvachem Corp., Panama City, FL, a subsidiary of the Arizona Chemical Co.

In a series of managerial changes, the following promotions have been announced by Davis Paint Co., Kansas City, MO: **Steve Bussjaeger**—Vice-President, Technical Division; **Daniel Hawthorne**—Vice-President, Stores Division; **Sandy Haskins**—Vice-President, Industrial Division; and **Kevin Ostby**—Vice-President, Dealer Sales Operation. Mr. Bussjaeger was Vice-President of the Kansas City Society in 1986.

The CIBA-GEIGY Corp., Hawthorne, NY, has announced the following appointments in their Plastics Department: **Wayne L. Franzen**—Midwest Regional Sales Manager; **James L. Hamner**—Southwest Technical Representative; and **Lee Hanson**—Southeast Technical Representative.

Mr. Franzen is a member of the Cleveland Society and Mr. Hamner is a member of the Rocky Mountain Society.

Milton C. Kintzley has joined Horizon Chemical, a division of A.E. Staley Mfg. Co., Decatur, IL., as Technical Sales Manager, wood products. Mr. Kintzley will control the sales of STA-MEG® methyl glucoside and other products used as resin modifiers for plywood and particle board production.

Union Carbide Corp.'s Emulsion Systems Group, Cary, NC, has announced the promotion of **Judith R. McCourt** to Account Representative in the western sales region. She will continue to handle latex sales to the paint and coatings and building products industries. Ms. McCourt is a member of the Los Angeles Society.

Kurfees Coatings, Inc., Louisville, KY, has promoted **John Ballard** to Director of Research. Mr. Ballard, who joined Kurfees in 1967, is a member of the Louisville Society. He is Chairman of the FSCT Paint Industries' Show Committee, and serves on the 1987 Annual Meeting Program, and Mattiello Lecture Committees.

Witco Corp., New York, NY, has announced the promotions of **Mark P. Wilson** to Purchasing Agent and **Susan B. Etterbeek** to Senior Buyer in the Corporate Purchasing Dept. Mr. Wilson formerly was a Senior Buyer for the company. Ms. Etterbeek most recently was a Buyer for chemicals and other raw materials.

The Silanes and Silicones Group, Dynamit Nobel Chemicals, has named **Gerald L. Larson** Manager, Research Products. He will serve as technical liaison with customers at the R&D level and oversee development of new silanes and silicon compounds for use by research scientists. Dr. Larson was formerly a professor of chemistry at the University of Puerto Rico.

David M. Setzer has been promoted to the newly-created position of Vice-President, Commercial Development at The McCloskey Corp., Wayne, PA. He will be responsible for acquisitions and mergers, technology licensing, joint ventures, and strategic planning for the Specialty Polymers Division.

Mr. Setzer, who joined The McCloskey Corp. in 1981, previously was Vice-President, Materials Management.

John Dittmar has joined the Hitox Corp. of America, Corpus Christi, TX, as Technical Services Manager. Mr. Dittmar has over 30 years experience in the industry and formerly was with TPI Industries. He is a member of the Houston Society.

FSCT Membership Anniversaries

25-Year Members

Golden Gate

Clyde L. Burger, of Kelly-Moore Paint Co.
Lowell Cummings, Consultant
Mark Donahoo, of Pride Paint Manufacturing Co.
Harold R. Harlan, Jr., of Harlan Associates, Inc.
George Hunt, of Kelly-Moore Paint Co.
Paul LaLiberte, of Universe Paint Co.
Robert LaPachet, of Polyvinyl Chemicals, Inc.
John T. March, of Intercoastal, Div. of Chemseco
Leon Persson, of Harrison & Crosfield Pacific, Inc.
Leo Schinasi, of Nuodex, Inc.
A.H. Thompson, Jr., of A.H. Thompson Co.

Devoe Marine Coatings Co., Louisville, KY, a division of Grow Group, Inc., promoted **Carlos Lopes** to Tech Services Manager for the East Coast. He will be responsible for the assignment of tech service personnel, coordination of the Rahway, NJ warehouse, and provide technical information support to district managers and salesmen. Mr. Lopes started with Devoe in 1968 and most recently was a Tech Service Representative.

The Jordan Chemical Co., Folcroft, PA, a subsidiary of PPG Industries, Inc., has announced the appointment of **William Allison** as Manager of Applications R&D. Mr. Jordan will apply his experience in the cosmetic, personal care, and household industries to Jordan's line of chemical specialties.

The Midland Division of the Dexter Corp., Waukegan, IL, has promoted **Roger Hoch** to Development Associate in the Packaging Group. Mr. Hoch joined Midland in 1976 and has contributed to their packaging coatings. He is a member of the Chicago Society.

The American Society for Testing Materials (ASTM), Philadelphia, PA, has elected a new Chairman, Vice-Chairman, Treasurer, and six Directors to the 1987 ASTM Board of Directors.

Robert Baboian, Electrochemical and Corrosion Laboratory, Texas Instruments, Inc., will serve a one-year term as Chairman of the Board. **David M. Greason**, retired, will serve a two-year term as Vice-Chairman. **Albert J. Bartosic**, Rohm and Haas Co., has been elected Treasurer.

The six new directors, who will serve three year terms, are: **Richard H. Brown**, Division of Surgical Research, St. Luke's Hospital, Cleveland, OH; **Rebecca Arnold Cohen**, Regulatory Alternatives Development Corp., Washington, D.C.; **Emery Farkas**, Construction Products Division, W.R. Grace & Co., Cambridge, MA; **Raymond G. Kammer**, National Bureau of Standards, Gaithersburg, MD; **Eberhard L. Schuerer**, Metallurgical Services, U.S. Steel Corp., Pittsburgh, PA; and **Paul A. Stringer**, National Research Council, Ottawa, Canada.

William R. Rooth and **Henry Hoaldridge II** are new Sales Representatives for Chemcentral Corp., Chicago, IL. Mr. Rooth, who joined Chemcentral in 1986, has prior experience in oil field equipment sales. Mr. Hoaldridge, formerly a sales representative in the oil industry, will be based in Dallas.

Charles Noonan has joined Reliable Coatings, Inc., Jackson, TN, as Technical Director and Operations Manager of its Powder Coatings Division. He will oversee the research, development, and manufacture of powder coatings for the thin film decorative, electrical, and functional markets. Mr. Noonan joins Reliable Coatings with 20 years of experience in the powder coatings industry.

Obituary

Fred W. Strom, retired owner and President of Ti-Kromatic Paints, Inc., St. Paul, MN, died December 27, 1986. He was 80.

Mr. Strom founded Ti-Kromatic Paints in 1948 after having worked in the paint industry with the Speed-O-Laq Corp. and the Farmers Union. He was an Active member and a Past-President of the Northwestern Society.

He is survived by a daughter, Nancy Soles, three sons, Terry, Philip, and Jack, and five grandchildren.

Anthony Skett, a Past-President of the New York Society, died on January 1. He was associated with the former Socony Paint Products Co.

Mr. Skett was a Society Honorary Member, Technical Committee Chairman in 1966-67, and received the Society's Roy H. Kienle Award in 1960.

Edward C. Schulte, retired Technical Director of the Coating and Resins Group, the Glidden Co., died February 1. He was 85.

Mr. Schulte joined Glidden in 1931 as a Paint Chemist in the grinding department. He is credited with establishing Glidden's R&D organization. His research and leadership resulted in the development of the first water-based interior and exterior latex paint, Spred Satin, which Glidden introduced in 1948.

Mr. Schulte is a Past-President of the Cleveland Society.

He is survived by his wife, Ruth, two sons, the Rev. Edward H. and Roger R., five grandchildren, and a sister.

Lawrence K. Scott, former Vice-President of technical administration at Celanese Coatings Co., died in September of 1986. He was 80 years old.

Kent State Univ. Features Coatings Short Courses

Kent State University will sponsor three short courses during the spring specifically designed for industrial technologists and scientists interested in cure characterization and property changes during cure, and fundamentals and applied information related to the practice of adhesion and dispersion.

"Thermal/Mechanical Properties and Cure Characterization of Coatings and Polymers," April 27-May 1, will feature discussions on macromolecular relaxation in amorphous and semicrystalline polymers, cure kinetics, thermosetting coatings, polyurethane coatings chemistry, and catalysis of amino resins.

"Adhesion Principles and Practice for Coatings and Polymer Scientists," May 11-15, will present the principles of surface chemistry related to adhesion, deformation and fracture of elastomeric and glassy adhesives and related fracture mechanics, surface preparation, plasma technology, adhesion promoters, surface analysis techniques, and tack and autohesion.

Academic and industrial scientists will present "Dispersion of Pigments and Resins in Fluid Media," June 1-5. They will discuss surface chemistry and physics related to the dispersion of pigments, and resins and latexes in classic solvent and water media. Dispersion of fillers, white, organic, black, and other related synthetic and natural pigments will be reviewed extensively. The program is targeted to benefit technical, research, development, and production personnel interested in adhesives, inks, coatings, elastomers, polymers, and other related material industries.

Details are available from Program Chairman Carl J. Knauss, Kent State Univ., Chemistry Dept., Kent, OH 44242 (216) 672-2327.

JSCM Conference Celebrates 60th Anniversary, Oct. 22-23

The Sixtieth Anniversary Conference of the Japan Society of Colour Material will be held in Tokyo, on October 22-23, 1987. The theme of the conference will be "Recent Progress in Colour Material Science" (of paints, coatings, printing inks, etc.).

Anyone wishing to submit a paper for presentation or attend the conference should write: Japan Society of Colour Material, 9-12, 2-chome, Iwamoto-cho, Chiyoda-ku, Tokyo 101, Japan. Manuscripts must be in English. Lectures and discussions will be held in both Japanese and English.

The President of the JSCM is Dr. Kenjiro Meguro, of the Science University of Tokyo.

"Resins: A Technology Update" Is Theme Of Philadelphia Society Seminar, May 4

The Philadelphia Society for Coatings Technology will sponsor a seminar entitled "Resins: A Technology Update," on May 4, at the Philadelphia Airport Inn. The program will feature a keynote presentation by John A. Gordon, of Eastern Michigan University. The seminar will include lectures in the areas of high solids, and water dispersible and latex resins technology. A special segment will highlight advances in urethane technology.

The presentations scheduled are:

- "Water-Borne Resins for Coatings Applied to Metal Surfaces"—Richard Johnson, of Cargill Inc.
- "Latex Technology—Past, Present, Future"—A. Clarke Boyce, of Nacan Products Ltd.
- "Determination of Cure Conditions for High Solids Alkyd and Polyester Coatings by Dynamic Mechanical Analysis (DMA)"—Karen K. Beckmann, of Reichhold Chemicals, Inc.
- "Comparison of Aliphatic Diisocyanates"—Richard R. Roeslar, of Mobay Chemical Corp.
- "Water-Based Polyurethanes"—Jim Goldsmith, of Wilmington Chemical Corp.

For further information concerning the seminar, contact: Program Chairman William J. Fabiny, Sermatech International Inc., 155 S. Limerick Rd., Limerick, PA 19468 (215) 948-5100 ext. 329.

"Present and Future Trends in Science and Technology" Is Theme of September 1988 FATIPEC Congress in Germany


L. Dulog

"Present and Future Trends in Science and Technology of Coatings and Their Compounds" will be the theme of the September 18-24, 1988 Congress of FATIPEC (the XIXth) in Aachen, Germany, at the Eurocongress Center.

FATIPEC is the Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe. It is composed of seven member associations: from France, Belgium, Holland, Germany, Italy, Switzerland, and Hungary. The official languages of FATIPEC are French, German, and English.

Hosts for the meeting will be the German members of FATIPEC: the Fachgruppe Anstrichstoffe und Pigmente in the Gesellschaft Deutscher Chemiker (Division of Coatings and Pigments in the German Chemical Society).

The President of FATIPEC (1987 and 1988) is Prof. Lothar Dulog, Director of Research at the Forschungsinstituts for Pigmente und Lacke e.V., in Stuttgart.

Anyone wishing to present a paper at the Congress must contact Dr. Dulog, c/o Forschungsinstitut und Lacke e.V., Allmandring 37, D-7000 Stuttgart, Germany. The title of paper and name of author must be submitted by September 1, and the abstract by December 1.

There will be no exhibit with the Congress. Plans are to feature research laboratories in the lobby of the Center.

Missouri-Rolla Schedules Fall '87 Coatings Courses

University of Missouri-Rolla will present four coatings short courses next fall. The courses are designed for painting contractors, maintenance engineers, and coatings specialists.

The courses are scheduled as follows: "Estimating for Painting Contractors and Maintenance Engineers"—September 9-11; 55th Introductory Short Course—"The Basic Composition of Coatings"—September 21-25; 15th Introductory—"Paint Formulation"—October 19-23; and "Conformal Coatings"—November 4-6.

For more information on these courses, contact the Coatings and Polymer Science Program, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249.

Aqueous Dispersions

A new line of aqueous organic pigment dispersions for use in aqueous printing inks, coatings, textile inks, rubber, and latex are highlighted in a recently released product bulletin. The dispersions are available in units ranging from five-gallon pails to 2000-pound tote bins. For additional information on the Sunsperse® 6000 dispersions, write Sun Chemical Corp., Dispersions Div., 3922 Bach-Buxton Rd., Amelia, OH 45102.

Multi-User Color System

A multi-user computer color system is featured in a recently released product bulletin. The system consists of an advanced spectrophotometer, and computer hardware and software for combinatorial color matching, batch correction, color quality control, formula storage, and other color control functions. Write Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543 for more information on the ACS 3050.

Functional Extender

A synthetic hydrous calcium silicate functional extender used to impart hiding power and reduce gloss and sheen in interior flat emulsion paints is described in a four-page brochure. The literature highlights performance characteristics, lists general properties, and offers tips for use. A copy of the Micro-Cel® T-38 brochure (FF-169) can be obtained by writing the Manville Service Center, 1601 23rd Street, Denver, CO 80216.

Epoxy Resins Hardener

Information has been released that describes a high performance hardener for epoxy resins. The hardener is particularly for solvent- and high-temperature resistant coatings. It is a low viscosity modified cycloaliphatic polyamine adduct, developed especially for coatings applications in tank linings, oil field piping, refineries, and chemical processing plants. A brochure containing chemical, formulation, and performance data on curved systems is available from the Plastics Dept., CIBA-GIEGY Corp., 3 Skyline Dr., Hawthorne, NY 10532.

Spectrocolorimeters

An eight-page, full-color brochure which provides detailed information about spectrocolorimeters, used for color and appearance measurement, is available. The brochure includes pictures and other graphics, examines the instruments' 0°/45° optical sensors, and covers the standard and optional features. For a copy of the LabScan family brochure, write Hunter Associates Laboratory, Inc., 11495 Sunset Hills Rd., Reston, VA 22090-5280.

General Products Guide

A 24-page general products guide has been published. Outlined in this color brochure are: chemical specialties, coatings, dyes, industrial adhesives, insulating glass sealants, injecta color, laminating and functional adhesives, organic specialty chemicals, powder coatings, radiation curable products, specialty polymers, textiles, and color dispersions. For copies, write Morton Chemical Div., 333 W. Wacker Dr., Chicago, IL 60606-1292.

Industrial Meter

Literature is available on a new industrial meter designed to measure chromaticity and color difference. The meter makes precise readings, which are processed by a built-in microcomputer and displayed on a custom-designed liquid crystal display. For more facts on the Minolta Chroma Meter CR-200B, write the Minolta Corp., Industrial Meter Div., 101 Williams Dr., Ramsey, NJ 07446.

Water-Borne Copolymer

A water-borne acrylic copolymer emulsion for formulating fast air-dry or force-dry industrial coatings on metals and plastics is introduced in a product bulletin. The new copolymer is supplied precoalesced, ready for use as a film former. It imparts adhesion and hardness to the coating, in addition to a balance of corrosion, chemical, and block resistance. For samples, starting point formulations, and technical information on NeoCryl® XA-6033, contact S.T. Krzynowek, Technical Marketing Manager, Polyvinyl Chemical Industries, 730 Main St., Wilmington, MA 01887.

Coatings Products

A brochure lists more than 30 products for use in coatings applications, including cellulose acetate butyrate esters, plasticizers, waxes, chlorinated polyolefins, polymers, glycols, solvents, and alcohols. For a copy of the brochure (No. CG-3) "Products for the Coatings Industry" or additional information, write Eastman Chemical Products, Inc., Coatings Chemicals, P.O. Box 431, Kingsport, TN 37662.

Wet-Ground Mica

Literature is available which details the properties and various applications of wet-ground mica. The mica has a high aspect ratio, maximum of delamination, surface smoothness, and also acts as a barrier to moisture and gas permeability. A copy of the literature on Muscovite Mica can be obtained by writing The Mearl Corp., Franklin Mineral Products Div., 41 E. 42nd St., New York, NY 10017.

Color and Gloss Standards

Recently released literature describes a visual master standards and a new glossmeter aimed at controlling both color and gloss of products and packaging. Write Munsell Color, 2441 N. Calvert St., Baltimore, MD 21218 for additional facts.

Antimicrobial Agent

Information is available on an antimicrobial agent that has received EPA registration for use as a preservative in metalworking fluids and latex paints. It is effective against both gram-positive and gram-negative bacteria. A technical bulletin from Angus Chemical Co., 2211 Sanders Rd., Northbrook, IL 60062 describes the physical properties of Bioban® GK.

Organosilanes Report

The possibility of increasing the reactivity of organosilanes through combination with organometallic esters in additives for highly filled thermoset resins has been demonstrated in research. Write Dynamit Nobel Chemicals, Silanes/Silicones Group, 2570 Pearl Buck Rd., Bristol, PA 19007 for more details.

Fluids Systems

A bulletin that describes the importance of measuring elasticity and viscosity in predicting the processing and end-use behavior of structured fluid systems has been published. A case study explains how viscoelastic properties can be used to optimize spray coating formulations. Write Rheometrics, Marketing Dept., One Possumtown Rd., Piscataway, NJ 08854 for Application Bulletin #9.

Grind Clays

Two clays that have a 5+ Hegman fineness of grind and are dispersable in a wide variety of aqueous and non-aqueous coating systems are the subject of a technical bulletin. Both clays find applications as extender pigments in paint and ink formulations. For additional information on Hydrite® RH and Hydrite® PXH, write Georgia Kaolin Co., Inc., Combustion Engineering Inc., 2700 U.S. Highway 22 East, Union, NJ 07083.

Computerized Filling Machine

A product bulletin describes a computerized filling and sealing machine for liquids and semi-liquids. The unit fills by volume, checks by weight, and automatically adjusts to compensate for deviations in the actual fill weight. It is capable of handling gasoline, solvents, oil, chemicals, paints, and greases. Additional details on the Model 571 are available from C.M. Ambrose Co., 2649 151st Place N.E., Redmond, WA 98052.

Coupling Agents Study

A study indicates that in comparison to monomeric silanes, the organic substitution of polymeric silanes in composite formulations has a greater effect on deposition of the silane. For additional information, write Dynamit Nobel Chemicals, Silanes/Silicones Group, 2570 Pearl Buck Rd., Bristol, PA 19007.

Elemental Analysis Equipment

A listing of publications directed at a line of elemental analysis equipment is available. For a complete listing of publications, free of charge, write Haake Buchler Instruments, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6002.

Flowable Biocide

Literature is available on a new liquid formulation fungicide that has been registered with the EPA. The biocide, a nontoxic iodine-based compound that inhibits the growth of bacteria and fungi species and terrestial algae, is intended as a mildewcide for latex paints, coatings, adhesives, and sealants, etc. Contact Dr. Mitchell Friedman, Abbott Laboratories, North Chicago, IL 60064 for additional information or free lab testing to determine the best concentration of Amical® Flowable for specific product applications.

Surfactants Brochure

A new brochure that describes how surfactants help produce stable latex products at high manufacturing efficiency is available. The literature discusses the differences between surfactants and conventional anionic surfactants in emulsion polymerization. A free copy of "Increasing Mechanical Stability and Reactor Yields with Dowfax® Anionic Surfactants for Emulsion Polymerization Applications" is available from Dow Chemical U.S.A., Inquiry Services/Dowfax EP, P.O. Box 1206, 1703 Saginaw Rd., Midland, MI 48640-9969.

Interactive Disks

Interactive disks that focus on solving problems involving low solvent coating applications are the subject of a technical product bulletin. Disks are available for powder, solvent resistant epoxy coatings, and acid and base resistance. For further details on the disks, write the Plastics Dept., CIBA-GEIGY Corp., 3 Skyline Dr., Hawthorne, NY 10532.

Silicone Additives

A new guide for selecting silicone additives for paints, inks, coatings, and adhesives is highlighted in literature. The brochure contains three color tables that summarize the functions, properties, and benefits of the additives. To receive the Spectrum System selection guide, contact Dow Corning Corp., Dept. 3371, Midland, MI 48686.

High Solids Resins

Technical literature details a new resin that allows the formulation of industrial baking finishes that meet the new California requirements of 275 grams per liter (2.3 pounds per gallon) VOC. Technical information and the VOC formula of SCD 1090 are available from SCD—Etna Products, Inc., P.O. Box 630, Chagrin Falls, OH 44022.

Phenolic Resins

Literature describes how phenolic resins developed for VOC-compliant, high-solids baking coatings for metal finishing. The heat-reactive phenolic resins are designed for use in phenolic or epoxy-phenolic formulations. Further information on BKS 2900 and 2910, including high-solids formulation suggestions, can be obtained from *Union Carbide Corp., UCAR Coatings* Resins, Dept. L4489, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Clear Coating System

An organic clear coat system for exterior application on clear plastic parts has recently been introduced in literature. The system provides UV stability, flexibility, weatherability, and abrasion and chemical resistance. The coating system applies with conventional spray equipment. Write the Bee Chemical Co., 2700 E. 170th St., Lansing, IL 60438 for further information on the Lensgard™ System.

Particle Size Analysis

A new technique for determining particle *size distribution and surface area* of powders between .01-3000 microns in diameter is the subject of a product bulletin. The procedure can be applied to non-porous and porous particles. For more facts, write Haake Buchler Instruments, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001.

Grinding Shaft

A twin disc grinding shaft and 1.8 liter jacketed grinding chamber are detailed in a recently released product bulletin. The shaft and chamber are suitable for use with all types of grinding media, including: sand, glass beads, zirconium silicate, zirconium oxide, ceramic, alumina ceramic, chrome steel, steel shot, and stainless steel. For more information, write Premier Mill Corp., 220 E. 23rd St., New York, NY 10010.

Alkylamines

An eight-page booklet on alkylamines and their applications in chemicals, plastics, elastomers, metals, petroleum, pharmaceuticals, textiles, paper, coatings, adhesives, and other industries has been released. The booklet describes alkylamines, lists the typical properties of six alkylamines, and uses a graph to show vapor pressure versus temperature. A copy of "Alkylamines" can be obtained from Union Carbide Corp., Solvents and Coatings Materials Div., Dept. L4488, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Rheology Measurements

A system which represents a new approach to rheology measurements is the subject of recently released literature. The system enables the user to do a variety of measurements including: coaxial cylinder, high shear rate, low shear rate, high temperature, high pressure, low viscosity, and dynamic measurements for viscoelastic property determination. For more information on the RV20, write Haake Buchler Instruments, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001.

Book Review

POLYMERIC MATERIALS FOR CORROSION CONTROL

Edited by
Ray A. Dickie
F. Louis Floyd

Published by
American Chemical Society
Washington, D.C. (1986)
IX + 359 pages, $69.95

Reviewed by
Raymond Comfort
Whirlpool Corporation
Benton Harbor, MI 49022

This book *Polymeric Materials for Corrosion Control* (No. 322) is another excellent collection of papers in the ACS Symposium Series. The book contains a good mix of general and specific topics. It also spans the spectrum of interests from basic research to methods of interest for the general laboratory.

The initial paper, "Polymeric Materials for Corrosion Control: An Overview," serves well as an introduction to the other papers presented in the book, which are divided into three major categories: Evaluation of Material Performance, Adhesion and Interfacial Aspects of Corrosion Protection, and Materials for Corrosion Protection.

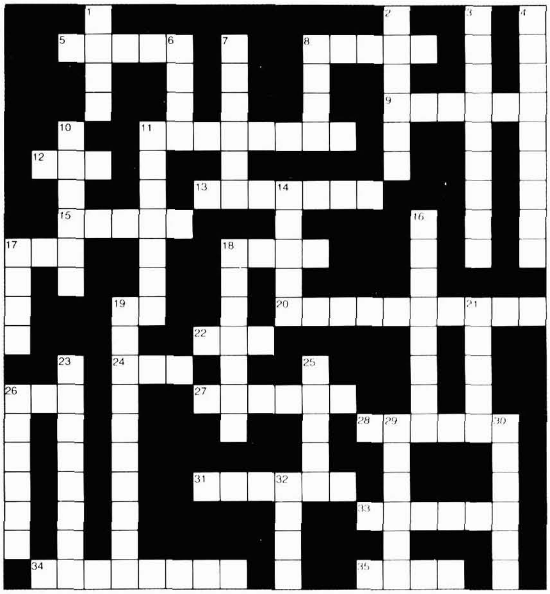
The addition of chapters such as the one on "How Organic Coating Systems Protect Against Corrosion" lends continuity to the book as well as being instructive.

This book also gives the reader a look at current technology in the area of corrosion control and many literature citations enable the reader to further pursue subjects of interest.

This book should serve well as a reference to those involved in the study of corrosion and its control.

CrOSSLinkS

by Earl Hill



No. 17

Solution to be published in May issue

ACROSS

5. S_____ resistance
8. Lac insect host tree
9. Pan
11. Test condition
12. To brush over
13. Unique silica filler
15. White (Syn.)
17. Measure of hardness (Abr.)
18. Thin wood strips
19. For example (Abr.)
20. Copying method
22. Film defect; a hole
24. Polymeric repeating unit
26. Spray technique; type of cure
27. Stone, usually decorative
28. Extender (Syn.)
31. To strain (Syn.)
33. Horizontal beam (construction)
34. How small it is
35. Stringy effect (Rheol.)

DOWN

1. Coil coaters (Abr.)
2. Surface sheen
3. Pigment type (Org. chem.)
4. Silicate mineral, N_____
6. Semi fossil resin
7. Naval
8. Circular wood defect
10. Color lightening
11. Contains molecules of water (Chem.)
14. Fine polymeric dispersion
16. OH radical (Chem.)
17. Place to dry wood
18. Flake-like
19. Incompatible, usually liquids
21. Thick pigment-resin mixture
23. To deface with writing/pictures
25. To set glass, as in a window
26. Hold on to
29. Element used to measure unsaturation
30. Used to apply paint
32. Preservative chemical oxide (Abr.)

Coming Events

FEDERATION MEETINGS

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

1987

(Apr. 29-May 2)—Combined Federation Spring Week and Pacific Northwest Society Symposium. The Westin Hotel, Seattle, WA. FSCT Society Officers Meeting on April 29; FSCT Board of Directors Meeting on April 30; Seminar on May 1-2. Concludes with a dinner dance on May 2.

(Oct. 5-7)—65th Annual Meeting and 52nd Paint Industries' Show. Convention Center, Dallas, TX.

1988

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

1989

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

SPECIAL SOCIETY MEETINGS

1987

(Apr. 7)—Detroit Society. 12th Annual Focus Conference, Management Education Center, Troy, MI. (Bohdan Melnyk, 26727 Newport, Warren, MI 48089).

(Apr. 7-8)—Chicago Society's Symco '87 "Risky Business: Technology of Our Times." Knickers, Des Plaines, IL. (William Fotis, The Enterprise Cos., 1191 S. Wheeling Rd., Wheeling, IL 60090).

(Apr. 20)—Louisville Society Seminar on "Critical Issues on the Manufacturing Process" and tour of Ford Motor Co. "Ranger" Truck Plant and new $70 Million Paint Shop. (Louis Holzknecht, Devoe Marine Coatings, 502-589-9340 ext. 284).

(Apr. 29-May 2)—Combined Federation Spring Week and Pacific Northwest Society Symposium. The Westin Hotel, Seattle, WA. April 29—FSCT Society Officers Meeting; April 30—FSCT Board of Directors Meeting; PNW Golf; PNW Evening Activities; May 1—Seminar; May 2—Seminar continued; PNW Sports Competition; Dinner Dance.

(May 4)—"Resins: A Technology Update." Philadelphia Airport Inn. Sponsored by the Philadelphia Society. (William J. Fabiny, Sermatech International Inc., 155 S. Limerick Rd., Limerick, PA 19468).

(May 27-28)—30th Annual Advances in Coatings Technology Conference. NASA's Lewis Research Center, Cleveland, OH. Sponsored by the Cleveland Society. (Sharon Kaffen, The Glidden Co., 16651 Sprague Rd., Strongsville, OH 44136).

(June 12-13)—Joint meeting of St. Louis and Kansas City Societies. Holiday Inn, Lake of Ozarks. (A.E. Zanardi, Thermal Science, Inc., 2200 Cassens Dr., Fenton, MO 63026).

1988

(Apr. 13-15)—Southern Society. Annual Meeting. Charleston, SC. (Scott McKenzie, Southern Coatings Co., P.O. Box 160, Sumter, SC 29150).

(Apr. 28-30)—Pacific Northwest Society. Annual Symposium. Vancouver, B.C., Canada. (Yvon Poitras, General Paint Corp., 950 Raymur Ave., Vancouver, B.C., Canada V6A 3L5).

1989

(Mar. 13-15)—Western Coatings Societies Symposium and Show. Disneyland Hotel, Anaheim, CA. (Andy Ellis, NL Industries, Inc., 200 N. Berry St., Brea, CA 92621).

OTHER ORGANIZATIONS

1987

(Apr. 21-23)—"Coatings Specifiers" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Apr. 27-28)—"Advances in Polyurethane Elastomers/Coatings Sealants and Adhesives" Seminar. Holiday Inn Chicago, Chicago, IL. (Lisa Sherk, Program Div., Technomic Publishing Co., 851 New Holland Ave., Box 3535, Lancaster, PA 17604).

(Apr. 27-May 1)—"Thermal/Mechanical Properties and Cure Characterization of Coatings and Polymers." Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Kent State University, Chemistry Dept., Kent, OH 44242).

(Apr. 29-30)—1987 Annual Spring Symposium sponsored by the Protective Coatings Division of the Canadian Society for Chemistry. The Old Mill, Toronto, Canada, and Le Pavillon, Montreal, Canada. (Gerry Parsons, MCIC, DeSoto Coatings Ltd., Toronto, or Bert Papenburg, MCIC, Canada Colors and Chemicals Ltd., Montreal).

(Apr. 29-May 1)—"Polymers for Electronic Applications" Course sponsored by State University of New York, New Paltz, NY. (Dr. A.V. Patsis, Chemistry Dept., State University of New York, New Paltz, NY 12561).

(Apr. 29-May 1)—"26th Annual Marine and Offshore Coatings Conference. Sponsored by the National Paint & Coatings Association, New Orleans Hilton Hotel, New Orelans, LA. (Ken Zacharas, NPCA, 1500 Rhode Island Ave., N.W., Washington, DC 20005).

(May 4-6)—"Crosslinked Polymers: Chemistry, Properties and Applications" Course sponsored by State University of New York, New Paltz, NY. (Dr. A.V. Patsis, Chemistry Dept., State University of New York, New Paltz, NY 12561).

(May 4-8)—"Introduction to Polymer Chemistry." Course sponsored by University of Missouri-Rolla, Rolla, MO. (Michael R. Van De Mark, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249).

(May 6-8)—"High Temperature Polymers: Chemistry, Properties and Applications" Course sponsored by State University of New York, New Paltz, NY. (Dr. A.V. Patsis, Chemistry Dept., State University of New York, New Paltz, NY 12561).

(May 11-14)—Powder & Bulk Solids Conference/Exhibition, O'Hare Exposition Center, Rosemont, IL. (Show Manager, Powder & Bulk Solids Conference/Exhibition, Cahners Exposition Groups, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, IL 60017-5060).

(May 11-15)—"Adhesion Principles and Practice for Coatings and Polymer Scientists." Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Kent State University, Chemistry Dept., Kent, OH 44242).

(May 11-15)—"Physical Testing of Paints and Coatings." Course sponsored by University of Missouri-Rolla, Rolla, MO. (Michael R. Van De Mark, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249).

(May 12-14)—HAZTECH Canada Exhibition and Conference. Toronto International Centre, Mississauga, Ontario. (Beverly Gibson, Exhibition Management Company, 6143 S. Willow Dr., Suite 100, Englewood, CO 80111).

(May 12-14)—"Process Hazards Management" seminar sponsored by the Du Pont Co., Reno, NV. (Du Pont Safety Services, Barley Mill Plaza, P19-1104, Wilmington, DE 19898).

(May 13-15)—"Polymer Blends and Alloys" Course sponsored by State University of New York, New Paltz, NY. (Dr. A.V. Patsis, Chemistry Dept., State University of New York, New Paltz, NY 12561).

(May 18-21)—Surface Coating '87. Chemical Coaters Association. Milwaukee, WI. (CCA, Box 241, Wheaton, IL 60189).

(May 20-22)—"Specialty Coatings for the Electronics Industry." Course sponsored by University of Missouri-Rolla, Rolla, MO. (Michael R. Van De Mark, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249).

(May 25-27)—*Ninth International Conference on Advances in* the Stabilization and Controlled Degradation of Polymers. Luzern, Switzerland. (Dr. A.V. Patsis, Institute of Materials Science, State Univ. of New York, New Paltz, NY 12561).

(May 28)—Symposium on Automotive Color Design. Jointly sponsored by the *Canadian Society for Color and the Detroit Colour* Council. Cleary Auditorium, Windsor, Ontario. (William V. Longley, Ford Motor Co., Design Center, 21175 Oakwood Blvd., P.O. Box 2110, Dearborn, MI 48123).

(May 28-31)—Cormaint Asia '87. Conference on Coatings and Corrosion Protection. Jakarta Fair Grounds, Jakarta, Indonesia. Co-sponsored by National Association of Corrosion Engineers. (IIR Exhibitions Pte Ltd., 89 Short St., Singapore 0718).

(May 31-June 5)—Sixth International Meeting on Radiation Processing. Skyline and Holiday Inn Hotels, Ottawa, Ont., Canada. (Mrs. E. Golding, International Meeting on Radiation Processing, P.O. Box 13533, Kanata, Ont., Canada K2K 1X6).

(June 1-5)—"Advances in Emulsion Polymerization and Latex Technology" short course, Lehigh Univ., Bethlehem, PA. (Dr. Mohammed S. El-Aasser, Dept. of Chemical Engineering, Sinclair Lab #7, Lehigh Univ., Bethlehem, PA 18015).

(June 1-5)—"Dispersion of Pigments and Resins in Fluid Media" Course. Sponsored by Kent State University, Kent, OH. (Dr. Carl J. Knauss, Kent State University, Chemistry Dept., Kent, OH 44242).

(June 3-6)—"High Solids Coatings" Short Course sponsored by North Dakota State University, Fargo, ND. (Dr. F.N. Jones, Polymers and Coatings Dept., North Dakota State University, Fargo, ND 58105).

(June 8-10)—"Radiation Curable Coatings" Short Course sponsored by North Dakota State University, Fargo, ND. (Dr. F.N. Jones, Polymers and Coatings Dept., North Dakota State University, Fargo, ND 58105).

(June 14-17)—Dry Color Manufacturers' Association Annual Meeting, The Greenbrier, White Sulpher Springs, WV. (Lynn Goodwin, P.O. Box 20839, Alexandria, VA 22320-1839)

(June 15-26)—"Coatings Science" Course sponsored by North Dakota State University, Fargo, ND. (Dr. F.N. Jones, Polymers and Coatings Dept., North Dakota State University, Fargo, ND 58105).

(June 17-19)—"*Chemically Modified Surfaces*" Conference co-sponsored by Colorado State University and Dow Corning Corp. Holiday Inn, Fort Collins, CO. (Ward T. Collins, Mail Stop C41C00, Dow Corning Corp., Midland, MI 48686-0994).

(June 17-20)—Oil and Colour Chemists' Association Biennial *Conference. Eastbourne, England. (Mr. R.H. Hamblin, Director &* Secretary, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HA0 2SF, England).

(June 22-24)—Fourth Annual International Bridge Conference. Sponsored by the Engineers' Society of Western Pennsylvania. Hilton Hotel, Pittsburgh, PA. (*International Bridge Conference, c/o* Engineers' Society of Western Pennsylvania, 530 William Penn Place, Pittsburgh, PA 15219).

(July 6-10)—13th International Conference in Organic Coatings Science and Technology. Athens, Greece. (Dr. A.V. Patsis, Institute in Materials Science, State Univ. of New York, New Paltz, NY 12561).

(July 13-16)—SUR/FIN '87 Chicago—International Conference & Exhibit of Electroplating and Surface Finishing. McCormick Place, Chicago, IL. (AESF, 12644 Research Parkway, Orlando, FL 32826).

(July 21-23)—"Process Hazards Management" seminar sponsored by the Du Pont Co., Wilmington, DE. (Du Pont Safety Services, Barley Mill Plaza, P19-1104, Wilmington, DE 19898).

(July 22-26)—Oil and Colour Chemists' Association, New Zealand Div. 25th Jubilee Convention. "Timber—Its Protection and Decoration." Rotorua, New Zealand. (Convention Coordinator, OCCA New Zealand, P.O. Box 5192, Auckland, New Zealand).

(Aug. 6-9)—Oil and Colour Chemists' Association Australia. 29th Annual Convention. Wrest Point Convention Center, Hobart, Tasmania, Australia. (OCCAA, 6 Wilson Ave., Felixstow, South Australia, 5090 Australia).

(Aug. 23-28)—"Copolymerization" Symposium. Sponsored by the Polymer Div. of the Royal Australian Chemical Institute and the Div. of Polymer Chemistry of the ACS. Sydney, Australia. (Prof. D.

Tyrell, Polymer Science & Engineering, Univ. of Massachusetts, Amherst, MA 01003).

(Aug. 30-Sept. 4)—American Chemical Society. 194th National Meeting. New Orleans, LA. (B.R. Hodson, ACS, 1155—16th St. NW, Washington, D.C. 20036).

(Sept. 9-11)—"Estimating for Painting Contractors and Maintenance Engineers." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249).

(Sept. 13-18)—"Mechanisms and Measurement of Water Vapor and Liquid Water through Materials" Symposium co-sponsored by ASTM Committees C-16, D-1, D-8, D-10, D-20, and F-2. Philadelphia, PA. (ASTM, 1916 Race St., Philadelphia, PA 19103).

(Sept. 15-18)—XVIIth Congress of AFTPV (French Association of Paint and Varnish Technicians) and Eurocoat. Nice, France. (J. Roire, 5, Rue Etex, 75018 Paris, France).

(Sept. 20-23)—Canadian Paint and Coatings Association. 75th Annual Convention. Four Seasons Hotel, Vancouver, B.C. (CPCA, 515 St. Catherine St. W., Montreal, Que., H3B 1B4 Canada).

(Sept. 21-25)—55th Introductory Short Course—"The Basic Composition of Coatings." Sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249).

(Oct. 14-16)—SURTEC '87 Berlin. International Congress Center, Berlin. (Gabriela Thal, 1625 K St., N.W., Suite 500, Washington DC 20006).

(Oct. 19-23)—15th Introductory—"Paint Formulation." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249).

(Oct. 20-22)—"Process Hazards Management" seminar sponsored by the Du Pont Co., New Orleans, LA. (Du Pont Safety Services, Barley Mill Plaza, P19-1104, Wilmington, DE 19898).

(Oct. 22-23)—60th Anniversary Conference of Japan Society of Colour Material, Tokyo, Japan. (Japan Society of Colour Material, 9-12, 2-chrome, Iwamoto-cho, Chiyoda-ku, Tokyo 101, Japan).

(Oct. 28-29)—Tenth Resins & Pigments Exhibition. Penta Hotel, London Heathrow Airport, England. (Polymers Paint Colour Journal, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England).

(Nov. 4-6)—"Conformal Coatings." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO 65401-0249).

(Nov. 7-11)—10th International Congress on Metallic Corrosion sponsored by Central Electrochemical Research Institute on behalf of International Corrosion Council. Madras, India. (Dr. V.I. Vasu, Chairman, ICMC Organizing Committee, Director CERI, Karaikudi 623006, Tamil Nadu, India).

(Nov. 20-22)—40th Annual Show and Convention of National Decorating Products Assn., McCormick Place, Chicago, IL. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132).

(Nov. 23-27)—Pacific Corrosion '87—Fifth Asian-Pacific Corrosion Control Conference in conjunction with the 27th Australasian Corrosion Association Conference. Hilton Hotel, Melbourne, Australia. (Bloomsbury Conference Services, P.O. Box 2368, Richmond, 3121, Australia).

(Apr. 5-7)—Electrocoat '88. Drawbridge Inn and Convention Center, Ft. Mitchell, KY. (Products Finishing, 6600 Clough Pike, Cincinnati, OH 45244).

(May)—Surfex '88. Sponsored by Oil and Colour Chemists' Association. Harrogate, England. (Fred Morpeth, P.O. Box 161, Wigan WN2 5TB, England).

(May 9-11)—Federation of Scandinavian Paint and Varnish Technologists. 12th Congress, Helsinki, Finland. (Arja Saloranta, Tikkurila Oy, PB 53, SF 01301 Vanda, Finland).

(June 5-11)—American Chemical Society. 195th National Meeting and Third Chemical Congress of North America. Toronto, Ont., Canada. (B.R. Hodson, ACS, 1155—16th St. NW, Washington, D.C. 20036).

(June 13-17)—International Conference on Composite Interfaces II. Case Western Reserve University, Cleveland, OH. (Professor H. Ishida, General Chairman, ICCI-II, Dept. of Macromolecular Science, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH 44106-1727).

(June 15-16)—Surfex '88. Oil and Colour Chemists' Association. Harrogate International Conference Center, Yorkshire, England. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HA0 2SF England).

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

(Oct. 18-21)—12th World Congress on Metal Finishing, INTERFINISH 88. Palais des Congres, Paris, France. (SEPIC INTERFINISH, 17 rue d'Uzes, 75002 Paris, France).

(Sept. 25-30)—American Chemical Society. 196th National Meeting. Los Angeles, CA. (B.R. Hodson, ACS, 1155—16th St. NW, Washington, D.C. 20036).

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BURGESS PIGMENT CO. **63**

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HENKEL CORP. **13**

INOLEX CHEMICAL CO. **17**

MC WHORTER, INC. **8-9**
MONSANTO CO. **2**

NUODEX INC., A HÜLS CO. **44**

ONTARIO RESEARCH FOUNDATION **56**

POLYVINYL CHEMICALS INC. **11**

ROHM AND HAAS CO. .... **4-5, Cover 3**

SHAMROCK CHEMICALS CORP. .... **Cover 4**
SYLVACHEM CORP. **15**

UNION CARBIDE CORP. .... **Cover 2-1, 36**

WITCO CORP. **48**

• • • • •

CLASSIFIED ADVERTISING **52**

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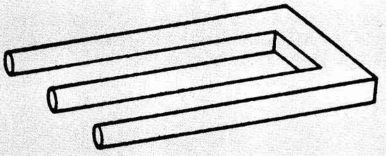
'Humbug' from Hillman

As part of Humbug's sadistic services, I am proud to present the "three-gated bifurcator," as forwarded to me by Owen Carpenter. In reference to the heading, "How To Go Crazy," I have no fear for this column's dedicated readers since repeated exposure has certainly made them immune.

How To Go Crazy!



This sketch is that of a "three-gated bifurcator," says the American Machinist. Be that as it may, we caution you, the wear and tear on your bifocals will be terrific if you try to see what you think you ought to see. The designer is unknown—and it's just as well.

—Chatham Blanketeer

Owen also included the following story, which is ascribed to QM Richard F. Johnson, of the U.S. Coast Guard.

The USS Constitution (Old Ironsides) as a combat vessel carried 48,600 gallons of fresh water for her crew of 475 officers and men. This was sufficient to last six months of sustained operations; she carried no evaporators.

HOWEVER (Historical Note)—

On 22 July 1798, the USS Constitution set sail from Boston. She left with 475 officers and men, 48,600 gallons of fresh water, 7400 cannon shot, 11,600 pounds of black powder, and 79,400 gallons of rum. Her mission—to destroy and harass British shipping.

Making Jamaica on 6 October, she took on 826 pounds of flour and 68,300 gallons of rum. Then she headed for the Azores, arriving on 12 November. She provisioned with 550 pounds of beef and 64,300 gallons of Portuguese wine. On 18 November she set sail for England.

In the ensuing days she defeated five British men-of-war, and captured and scuttled 12 English merchantmen, salvaging only the rum. By 27 January her powder and shot were exhausted.

Unarmed, she made a night raid up the Firth of Clyde. Her landing party captured a whisky distillery and transferred 40,000 gallons aboard by dawn. Then she headed for home.

The USS Constitution arrived in Boston on 20 February 1799 with no cannon shot, no food, no powder, no rum, no wine, no whisky, and 48,600 gallons of stagnant water.

The World's Mysteries According To Humbug

By the time you read this (but unknown to me at the time of this writing), all the following will probably have been revealed to an anxious Humbug.

—Did he know or didn't he know and how much did he know, if he knew anything; and why he didn't know that he knew— Or have we forgotten to ask?

—Did we win the America's Cup? I have yet to figure out why I care. Maybe if we won, our foreign policy image improved.

—Did Oral Roberts get his eight million bucks or did he get his first class, free trip to Heaven on March 31st?—Or both!

—Has the President kept his good health? I certainly hope so. Any further discussion of his prostate condition will be more painful than I can handle. Every time I saw pictures of our male innards during his last episode, I doubled up with empathetic agony.

Thoughts That Earl Hill Has Pondered

- The bottom line is that there is no bottom line!
- Even a stopped clock is right twice a day.

—Polish proverb

- For three days after death, hair and fingernails continue to grow, but the phone calls taper off.

—Johnny Carson

- Preaching what ain't paid for ain't worth listening to.

—Anon.

- I don't want yes men around me. I want everyone to tell me the truth—even if it costs them their job.

—Sam Goldwyn

- Executive ability is to decide quickly—and getting someone else to do the job.

—J.G. Pollard

- Anyone can do any amount of work, provided it isn't the work he's supposed to be doing at the moment.

—R. Benchley

- Nature invented time so that everything wouldn't happen at once.

—Woody Allen

- It's tough to make predictions, particularly about the future.

—Yogi Berra

—Herb Hillman
Humbug's Nest
P.O. Box 135
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Air Dry	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Wood Lacquers		✓	✓		✓	✓	✓	✓	✓		✓	
Powder Coatings	✓				✓						✓	✓
Flexible Packaging		✓			✓		✓	✓	✓	✓	✓	
Automotive Topcoats					✓		✓	✓	✓	✓		
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Rigid Packaging		✓	✓			✓	✓	✓	✓	✓	✓	
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Mar Resistance	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Abrasion** Resistance			✓					✓			✓	
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