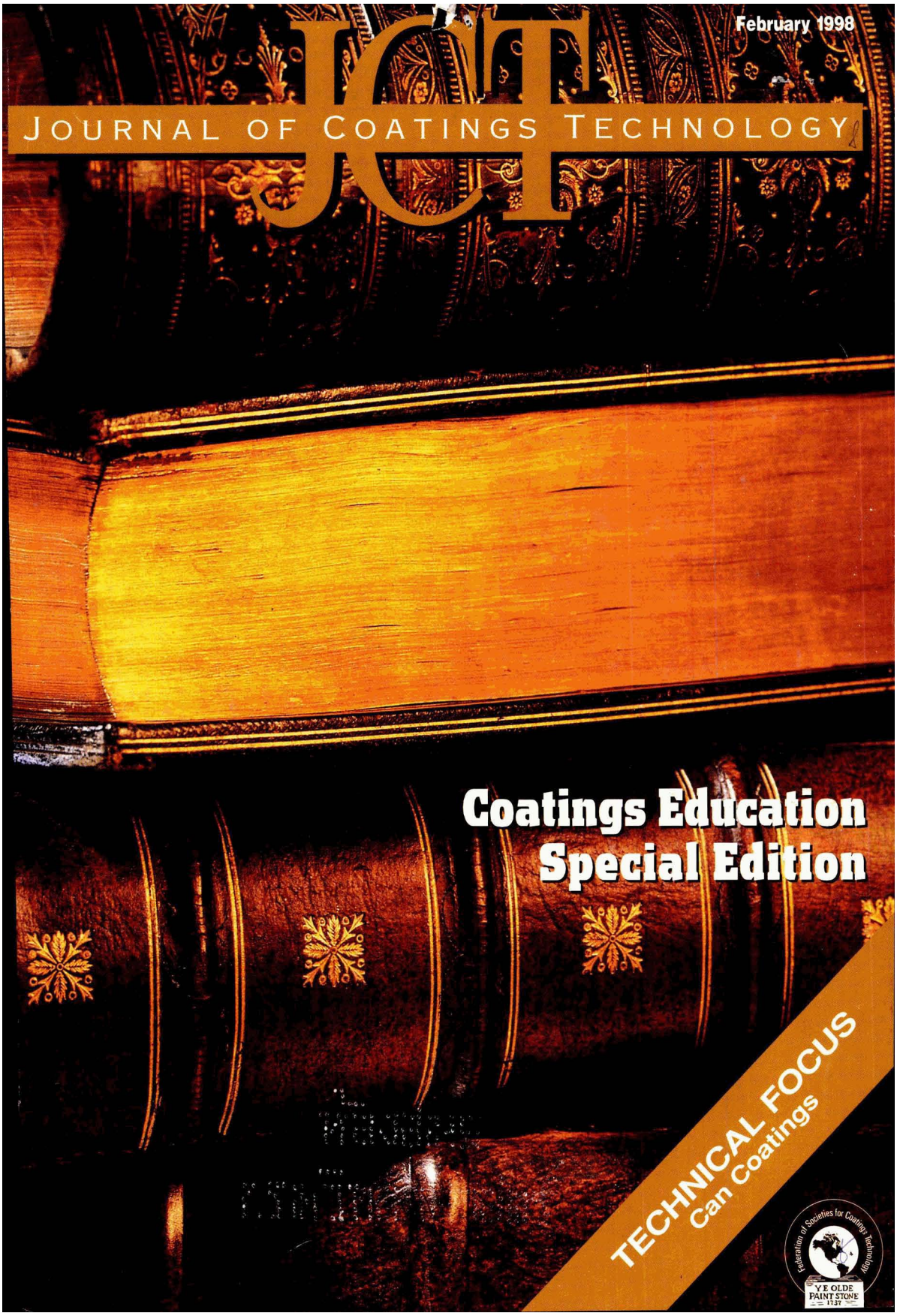
February 1998

JCT
JOURNAL OF COATINGS TECHNOLOGY



Coatings Education Special Edition

TECHNICAL FOCUS
Can Coatings

Federation of Societies for Coatings Technology
YE OLDE PAINT STONE 1737

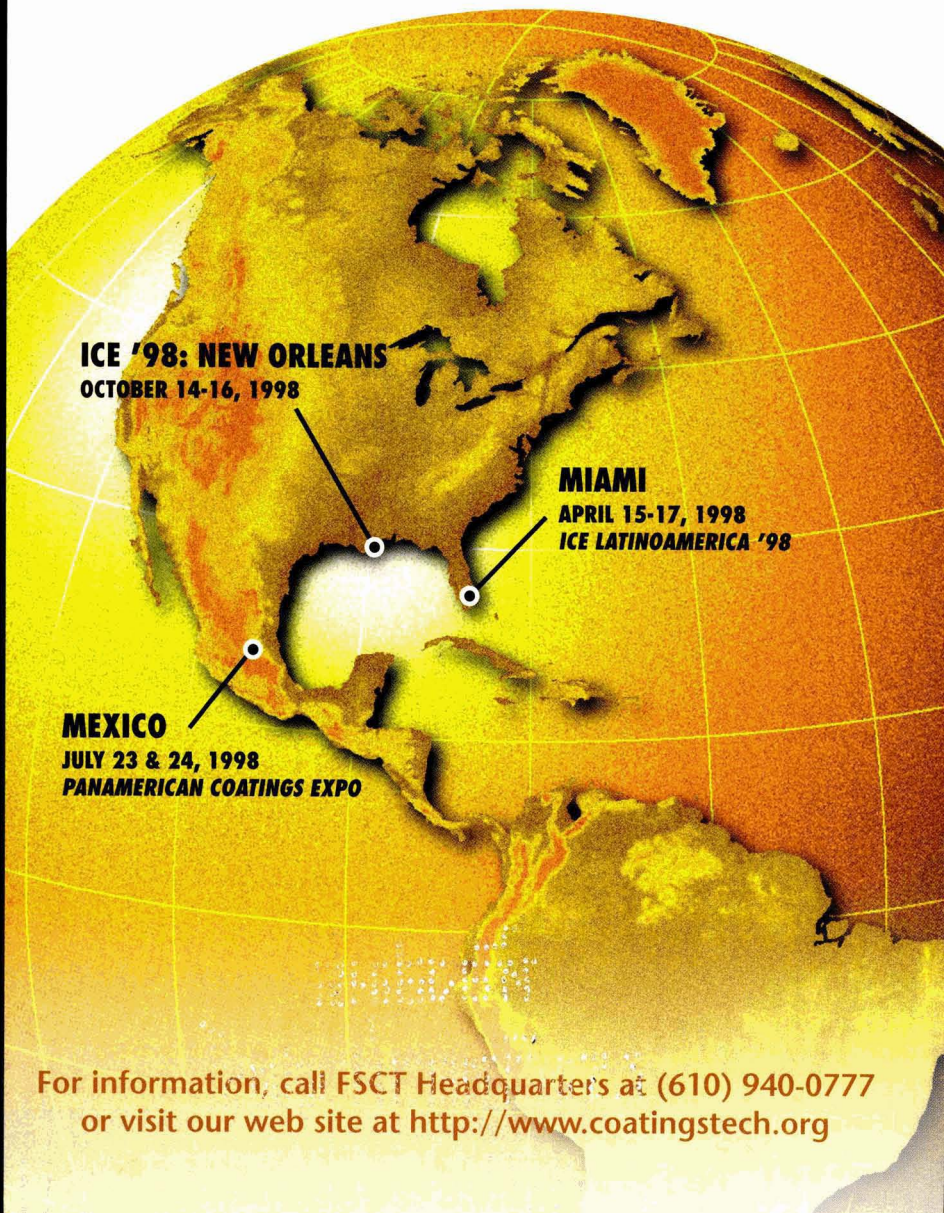
The Americas *at your* Fingertips

FSCT'S 1998 SHOWS

ICE '98:
NEW ORLEANS
OCTOBER 14-16, 1998
ERNEST N. MORIAL
CONVENTION CENTER
NEW ORLEANS,
LOUISIANA

MIAMI
APRIL 15-17, 1998
ICE LATINOAMERICA '98
MIAMI BEACH
CONVENTION CENTER
MIAMI, FLORIDA
Reaching:
The Caribbean
Central America
South America

MEXICO
JULY 23 & 24, 1998
PANAMERICAN
COATINGS EXPO
WORLD TRADE CENTER
MEXICO CITY, MEXICO



For information, call FSCT Headquarters at (610) 940-0777
or visit our web site at http://www.coatingstech.org

Looking for low cure and high stability in waterborne coatings?

STOP LOOKING!

If you're looking for easy to handle, one-package stability, you've found it. NACURE® X49-110.

NACURE® X49-110 is a unique DNNDSA blocked acid catalyst that promotes low temperature cure, excellent stability and high reactivity in amino crosslinked systems. It offers:

- Excellent water, corrosion and detergent resistance without residual amines;
- Cures as low as 225°F with polymeric melamines and ureas; 250°F with HMM type crosslinkers;
- Good adhesion, salt spray resistance, and excellent film properties;
- Reduced wrinkling compared to pTSA catalysts;
- Recommended for primer, coil coating, metal deco applications;
- Low conductivity makes it ideal for electrostatic spraying;
- Versatile enough to be post added.

For a truly unique catalyst for one package systems, look no further than NACURE® X49-110.

For more information, please write or call.

LLOYD'S REGISTER QUALITY ASSURANCE ISO 9001

USA
Science Rd., Norwalk, CT 06852 Tel: (203) 866-5551 FAX: (203) 866-1268

EUROPE
Noordkade 64, 2741 EZ Waddinxveen, The Netherlands
Tel: (0) 182-631360 FAX: (0) 182-621002

KING INDUSTRIES
SPECIALTY CHEMICALS

Circle No. 261 on the Reader Service Card

Two-thirds of the earth's surface is covered by water.

So far.

New SCX-1970. The first in a line of high performance waterborne polymers.

The world of protective **WOOD** coatings is about to change. Introducing SCX 1970, the ultimate in performance and protection.

SCX-1970 is a convenient one package, self-crosslinking acrylic emulsion. It offers a high level of chemical and microfoam resistance, extraordinary clarity, adhesion and sandability–all without emitting formaldehyde.

The superior cost/ performance balance also makes SCX-1970 attractive for **PLASTIC** and **CONCRETE** coating applications.

Imagine the possibilities. For more information call 800-231-7868.

SC Johnson Polymer

©1998 S.C. Johnson & Son, Inc. All rights reserved.

Circle No. 262 on the Reader Service Card

JCT
JOURNAL OF COATINGS TECHNOLOGY

FEBRUARY 1998 VOL. 70, NO. 877

Technical Articles

Open Forum

Federation News

Spotlight

Departments

© 1998 by FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

The JOURNAL OF COATINGS TECHNOLOGY (ISSN 0361-8773) is published monthly by the Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422-2350, Phone (610) 940-0777; Fax: (610) 940-0292.

Periodicals postage paid at Blue Bell, PA and at additional mailing offices. POSTMASTER: Send address changes to JOURNAL OF COATINGS TECHNOLOGY, 492 Norristown Rd., Blue Bell, PA 19422-2350.

Canada Post International Publications Product Sales Agreement No. 1227238.

Subscription: U.S. and Canada – 1 year, $120; 2 years, $220; 3 years, $340. Europe (Air Mail) – 1 year, $180; 2 years, $340; 3 years, $520. Other Countries – 1 year, $150; 2 years, $280; 3 years, $440.

ห้องสมุดกรมวิทยาศาสตร์บริการ

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 27 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 submission of original research papers, review papers, and papers under the special headings *Open Forum* and *Technology Forum,* and *Letters to the Editor.* All manuscripts will be assumed to be previously unpublished writing of the authors, not under consideration for publication elsewhere. When review papers contain tables or graphs from copyrighted articles, the authors will be required to obtain permission for use from the copyright holders. When the organization with which the authors are affiliated requires clearance of publications, authors are expected to obtain such clearance before submission of the manuscript. 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. 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 regional meetings or symposia of the Constituent Societies.

Papers in which proprietary products or processes are promoted for commercial purposes are specifically not acceptable for publication.

SUBMISSION OF MANUSCRIPTS...

...for the Journal

Four complete copies should be sent to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 492 Norristown Rd., Blue Bell, PA 19422. The cover letter should address copyright, clearance, and release issues discussed above and should specify paper category: *Original Research, Reviews, Open Forum,* or *Technology Forum.*

Letters 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 Mike Bell, Director of Educational Services, FSCT, 492 Norristown Rd., Blue Bell, PA 19422.

...for Roon Foundation Award Competition

Ten complete copies of the manuscript are required, and should be submitted to Mike Bell at the address previously listed. (For complete details, see "Roon Awards" section of the JOURNAL in the January 1998 issue.)

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).

Authors are encouraged to consider submissions in several categories and to prepare their manuscripts accordingly. The categories are:

Original Research Papers: Original research papers are the main technical content of the JOURNAL OF COATINGS TECHNOLOGY. Editors support the trend in scientific writing to a direct, less formal style that permits limited use of personal pronouns to avoid repetitious or awkward use of passive voice.

Review Papers: Papers that organize and compare data from numerous sources to provide new insights and unified concepts are solicited. Reviews that show how advances from other fields can beneficially be applied to coatings are also desired. Reviews that consist mainly of computer searches with little attempt to integrate or critically evaluate are not solicited.

Open Forum: Topics for this category need not be research papers and may be non-technical in nature, dealing with any aspect of the coatings industry. The subject may be approached informally. Editors encourage submission of manuscripts, including articles dealing with business and policy issues, that constructively address industry problems and their solutions.

Technology Forum: Papers that provide useful guides to Federation members in carrying out their work are solicited. Topics in this category are technical but focus on the "how to" of coatings technology. Useful calculations for coatings formulation and procedures that make a paint test more reproducible are examples of suitable topics. Process and production topics, i.e., paint manufacture, will also be reviewed in this category.

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 must be given. If someone other than the author of the paper made the presentation, this information, too, should be noted. Papers originally composed for oral presentation must be revised or rewritten by the author to conform to the style described in this guide.

Manuscripts should be typed with double spacing on one side of $8^1/2$ x 11 inch (22 x 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.

Electronic submissions are requested as a supplement to the hard copies and original figures normally required. The text should be submitted on 3.5" disk formatted for IBM or Apple Macintosh (or compatible system). Text files should be saved in the word-processing format in which they were prepared. The file on disk MUST exactly match the accepted hard copy version. Graphics (figures, drawing, etc.) should be in a separate file. Submitted disks must be labeled with the author's name, paper title, computer platform type (e.g., IBM compatible), software (and version) used, and file names. Complete instructions for electronic submission can be obtained from the Editor.

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' Affiliation and Address

Give complete names, company or institutional affiliations, mailing address and e-mail address (if available) for all the authors on the title page of the manuscript.

Abstracts

A 75–100 word abstract must be part of the manuscript, and should be a concise statement of the key methods and 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

Main headings and sub-headings should be used to improve readability, and to break up typographical monotony. The text should *not* be presented as an alphanumeric outline.

The main headings usually should be INTRODUCTION, EXPERIMENTAL, RESULTS AND DISCUSSION, and SUMMARY or CONCLUSIONS. Sub-headings will be specific to the subject.

Only as much review as is necessary to set the work in context and to make clear the significance of the work presented should be given as 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 afterwards in parentheses. The ASTM Metric Practice Guide, E 380-72 (American Society for Testing and Materials, 100 Barr Harbor Dr., W. Conshohocken, PA 19428-2959) is a convenient reference.

Tables, Graphs, Drawings, and Photographs

Tables, rather than descriptive text, should be used only when they are genuinely helpful. 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 nonphotographic blue-lined 8 1/2 x 11 inch paper. Each graph should be drawn on a separate sheet, numbered, and the captions listed on a copy of the original graph.

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

Color prints, slides, and graphics are generally not acceptable, but the selective use of color will be considered on a case-by-case basis when required for unambiguous presentation of scientific information.

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. For oligomeric or polymeric materials, characteristics such as molecular weight, polydispersity, functional group content, etc. should be provided.

Equations

Equations 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] books, [4] and patents.[5]

(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. 1, John Wiley & Sons, Inc., New York, 1973.

(5) Henderson, W.A. Jr. and Singh, B. (to American Cyanamid Co.), U.S. Patent 4,361,518 (Nov. 30, 1982).

OTHER INFORMATION

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

Reprints 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.

* * * *

The JOURNAL OF COATINGS TECHNOLOGY is copyrighted by the Federation of Societies for Coatings Technology. The editorial contents of the JOURNAL may not be reprinted in whole or in part without written permission of the publisher.

JCT JOURNAL OF COATINGS TECHNOLOGY

492 Norristown Road • Blue Bell, PA 19422-2350

The JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology at 492 Norristown Rd., Blue Bell, PA 19422-2350. Phone: (610) 940-0777. FAX: (610) 940-0292; Web Site: http:www.coatingstech.org.

Annual dues for Active and Associate Members of the Federation of Societies for Coatings Technology is $25.00. Of this amount, $16.75 is allocated to a membership subscription to this publication. Membership in the Federation is obtained through prior affiliation with, and payment of dues to, one of its 27 Constituent Societies. Non-member subscription rates are:

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$120.00	$180.00	$150.00
2 Years	$220.00	$340.00	$280.00
3 Years	$340.00	$520.00	$440.00

When available, single copies of back issues of the JOURNAL OF COATINGS TECHNOLOGY are priced as follows: $10.00 each for current calendar year issues; $15.00 each for all other issues.

Publisher ..... Robert F. Ziegler
Editor ..... Patricia D. Ziegler
Technical Editor ..... Ray A. Dickie
Managing Editor ..... Kathleen M. Wikiera
Associate Editor ..... Jonna D. Coachman
Director of Marketing ..... Lyn Pollock
Subscription Fulfillment Manager ..... Audrey E. Boozer
National Advertising Representative ..... Scott Walter
22785 Cass Ave., Woodland Hills, CA 91364
(818) 224-3226; Fax: (818) 222-0194

Publications Committee
B. Carr, Chair
R.E. Bish, R.A. Dickie, J. Hinkle, L. Price, J. Stauffer, R. Woodhull, P.D. Ziegler, R.F. Ziegler

Editorial Review Board
Ray A. Dickie, Chair
M. Ahmed, D.R. Bauer, H. Bender, R.F. Brady, Jr., J.H. Braun, C.R. Hegedus, L.W. Hill, S.F. Kia, J.V. Koleske, J.W. Martin, J.L. Massingill, D. Nordstrom, P.E. Pierce, G.R. Pilcher, T. Provder, R.A. Ryntz, C.K. Schoff, R. Stanziola, J.O. Stoffer

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

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

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

Copyright 1998 by the Federation of Societies for Coatings Technology. All rights reserved. No portion of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording or by any information storage or retrieval system without permission in writing from the publisher. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients is granted by the Federation of Societies for Coatings Technology for users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $1.00 per copy, plus .25 per page is paid directly to CCC, 27 Congress St., Salem, MA 01970. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transaction Reporting Service is: 0032-3352/86 $1.00 + .25.

FSCT Board of Directors—1997-98

PRESIDENT
**THOMAS E. HILL*
Merlyn Group
P.O. Box 768
Amherst, NY 14051-0768

PRESIDENT-ELECT
**FOREST FLEMING*
Akzo Nobel Coatings Inc.
1431 Progress St.
P.O. Box 2124
High Point, NC 27261

SECRETARY-TREASURER
**GERRY J. GOUGH*
ICI Packaging Coatings
Holden Surface Coatings Ltd.
Bordesley Green Rd.
Adderley Park, Birmingham, B9 4TQ, England

DEBAR W. ALLEN
Bruning Paint Co.
Baltimore, MD

GEORGE AMRICH, JR.
Benjamin Moore & Co.
Flanders, NJ

EVANS ANGELOS
Omya, Inc.
Clarendon Hills, IL

**JAY AUSTIN*
Halox Pigments
Hammond, IN

A. CLARKE BOYCE
A.C.B. Consultants
Oakville, Ont., Canada

DONALD W. BOYD
PPG Industries, Inc.
Allison Park, PA

LARRY BRANDENBURGER
The Valspar Corp.
Minneapolis, MN

VALERIE BRAUND
General Paint Ltd.
Vancouver, B.C., Canada

J. BROWN
Blagden Chemicals Ltd.
Cheshire, England

BRENDA L. CARR
Coatings Development Co.
Painesville, OH

J. ANDREW DOYLE
National Paint and Coatings Association
Washington, D.C.

**VAN S. EVENER*
Toledo, OH

PAMELA GEDDES
IIMAK
Amherst, NY

JAMES E. GEIGER
Consultant
Largo, FL

**TERRY GELHOT*
Carboline Co.
St. Louis, MO

JAMES D. HALL
ICI Paint Co.
Los Angeles, CA

MARCELO HERRERA
DuPont, S.A. de C.V.
Mexico, D.F., Mexico

WILLIAM M. HOLLIFIELD
D & L Paint Co.
Liberty, IN

DAVID JACK
Technical Coatings Co., Ltd.
Burlington, Ont., Canada

CHARLES A. KAPLAN
Gillespie Coatings, Inc.
Longview, TX

MAUREEN M. LEIN
Textron Automotive Technology
Dover, NH

GARY MARSHALL
Chemcraft Sadolin Inc.
Walkertown, NC

JAMES A. McCORMICK
Enhansco
Ponte Vedra Beach, FL

**J. DICK MULLEN*
G-3 Industries
Aurora, CO

LAWRENCE J. MURPHY
Tnemec Co., Inc.
N. Kansas City, MO

HORACE PHILIPP
PWGSC
Ottawa, Ont., Canada

GEORGE R. PILCHER
Akzo Nobel Coatings Inc.
Columbus, OH

YVON POITRAS
Richmond, B.C. Canada

GAIL POLLANO
Zeneca Resins
Wilmington, MA

PATRICIA SHAW
Radiant Color
Richmond, CA

JEFFREY C. STURM
Kop-Coat Inc.
Pittsburgh, PA

GUY SULLAWAY
International Paint Co.
Houston, TX

ROBERT D. THOMAS
Consultant
Media, PA

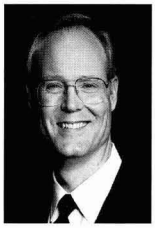
ANDREW TRAISTER
Courtaulds Coatings, Inc.
Louisville, KY

**Executive Committee Membe*

EXECUTIVE VICE PRESIDENT
ROBERT F. ZIEGLER
FSCT Headquarters
492 Norristown Rd.
Blue Bell, PA 19422

COMMENT

CIEF: Investing in the Future



Farewells are never easy, but—at various junctures in life—they are both necessary and inevitable. In this instance, the farewell is my farewell, and it is to the Coatings Industry Education Foundation, an organization with which I have been associated for the past decade and in which I have invested time, effort and love—and, on occasion—blood, sweat, tears, and good old-fashioned hard work. When I joined the CIEF Board, it bore no resemblance to the dynamic, highly-visible organization which we know today. Back in 1987, it was known as the Coatings Industry Education Fund (it didn't become the "Foundation" until 1993), and was legally established to serve one purpose, and one purpose only: to function as the legal custodian of the Roon Award Fund, which required such a guardian upon the demise of PRI. CIEF's total assets were comprised of the $100,000 principal in the Roon Fund, and its only duties consisted of holding an annual meeting to satisfy the corporate laws of the State of Delaware . . .

. . . and then something wonderful, but unpredictable, happened. Under the leadership of Neil Estrada, and his successor Loren Hill, the Trustees of the CIEF decided that—if they were sitting on the Board of the Coatings Industry **Education** Fund—then they should be doing something to advance the education of the industry. The result is history, a history as short as it is startling. From its modest beginning, the CIEF has grown from a "Fund" to a "Foundation," administers assets of over $400,000, and, in 1997, received annual funding approaching $100,000 from the Federation and a group of concerned corporate supporters. These funds support outstanding coatings programs at six major universities with annual grants for scholarships, fellowships, and —when funds are available and the requests are appropriate—capital grants for the desperately-needed equipment which is increasingly difficult for the "coatings schools" to obtain. Along the way, CIEF provided "seed money" to assist the start-up of the Cal Poly Coatings Program; created the "Joseph A. Vasta Memorial Scholarship in Coatings Science," which honors one of our industry's most beloved and innovative scientists by awarding $2500 annually to an outstanding senior in a university coatings program, and, in 1992, established the "Honor and Remembrance Fund," which is a vehicle to honor both living and deceased members of the coatings industry. Because the mission of the CIEF was so clear—and its Board so dynamic and proactive—the NPCA saw fit, over the years 1993-96, to transfer assets from the Trigg Foundation to the CIEF. This deeply-appreciated gift of over $140,000 has been used as the principal for the CIEF/Trigg scholarships, each in the amount of $2500, which are given to the six coatings programs on a rotating basis. But things didn't stop there . . .

. . . When the CIEF's principal source of funding, the Federation, was forced to cut back on their donations in the mid-1990's, the Trustees created **Project Tomorrow**, a major initiative to raise badly-needed funds from private industry. Although not launched until April of 1997, this program had already raised $25,000 by the time ICE was held in early November, and it holds bright promise for the future of CIEF and the coatings schools which it supports.

Will it end here? Definitely not. CIEF was borne out of the need for change; it has evolved in response to change; and its future will be guided by the demand for change. The Trustees recognize that change must be accommodated if we are to survive—and embraced, if we are to flourish. This is the hallmark of a dynamic organization, and its latest response to change—the appointment of Rick Hille and Rose Ryntz to replace departing trustees Don Boyd and George Pilcher—was the sort of visionary action that assures CIEF of a bright future.

I say "farewell" to a Board that is healthier, more dynamic, and more forward-thinking than ever before; a Board with its eyes fixed firmly on the future— a Board determined to "do whatever it takes" to deal with both the challenges and the opportunities that the future will surely present.

George R. Pilcher
Past-President and Trustee, CIEF

Technical Abstracts

Spanish translations provided by Marina Estévez, Technical Chief, Instituto Mexicano de Tecnicos en Pinturas y Tintas.(ANAFAPYT)

Potential Exposure to Bisphenol A from Food-Contact Use of Epoxy Coated Cans—S.R. Howe, L. Borodinsky, and R.S. Lyon

JCT, Vol. 70, No. 877, 69 (Feb. 1998)

The potential dietary exposure to bisphenol A (BPA) from the use of food and beverage cans coated with bisphenol A-based epoxies was determined. The calculation was made on the basi of migration data from extraction studies performed on unused commercial cans using the customary procedures developed by the United States Food and Drug Administration (FDA). The potential migration of BPA from beverage and food cans was determined using food-simulating solvents and time and temperature conditions recommended by FDA; these testing conditions amply exaggerate actual use conditions. The study demonstrates that no detectable BPA was found in the extracts from beverage cans using a method sensitive to five parts per billion (5 ppb) in the food simulant; the average migration of BPA from food cans was determined to be 37 ppb. Using these data, along with information regarding the use patterns for food and beverage cans, the maximum potential dietary exposure to bisphenol A from use of epoxy can coatings was estimated to be approximately 2.2 ppb. Because the conditions of the migration tests exaggerate actual use conditions, this value overstates the reasonably anticipated actual potential exposure.

Exposición Potencial a Bisfenol A por el Contacto con Alimentos de Latas Recubiertas con Epoxy—S.R. Howe, L. Borodinsky, and R.S. Lyon

Se determinó la exposición potencial a Bisfenol A (BPA) a partir de latas para alimentos y bebidas recubiertas a base de sistemas epóxicos, el la dieta diaria. El cálculo fue hecho a partir de estudios de extracción efectuados sobre latas comercialmente poco usadas. Los procedimientos empleados son los acostumbrados por la Administración de Alimentos y Farmacos de los Estados Unidos (FDA). La cantidad de BPA que migra hacia los alimentos y bebidas se determino utilizando solventes simulando alimentos a las condiciones de tiempo de exposición y temperatura recomendados por la FDA. Estas condiciones de prueba son muy exageradas con respecto a las condiciones de uso. Este estudio demostró que no se pudieron detectar rastros de BPA en los extractos de las latas para bebidas utilizando un método sensibl a 5 partes por billón (5 ppb) en los alimentos. Se cuantificó en 37 ppb. el promedio de migración de BPA a partir de latas para alimentos. Utilizando estos datos, se determino que el máximo potencial de BPA debe ser de 2.2 ppb. en la dieta. Debido a que las condiciones de las pruebas de migración son exageradas, los valores reportados están sobrevaluados pero anticipan el potencial de exposición actual.

Development of Methods for the Determination of Bisphenol A in Food Simulants—R. J. Wingender, P. Niketas, and C.K. Switala

JCT, Vol. 70, No. 877, 75 (Feb. 1998)

Epoxy resins based on bisphenol A (BPA) have been used as components of food and beverag can coatings for more than 50 years. The recent interest in analysis of extractable BPA from these resins has made it necessary to develop validated methods with performance characteristics necessary for successful analyses in regulatory food simulants. The present study was conducted to develop analytical methodology so that suitably equipped laboratories could confidently perform these analyses. Two methods were developed and validated through rounc robin sampling. A historical treatment of the method development challenges, round robin studies, and results are described here.

Desarrollo de Métodos Para la Determinación de Bisfenol A en Simuladores de Alimentos—R.J. Wingender, P. Niketas, and C.K. Switala

Por más de 50 años se han venido utilizando como recubrimentos de latas para comida y bebidas resinas epóxicas a base de Bisfenol A (BPA). En los años recientes ha crecido el interé en el desarrollar métodos validos de análisis, con las características necesarias para que sean accesibles como métodos de análisis regulatorios en los simuladores de alimentos que determinen la cantidad de BPA que se extrae de estas resinas. El presente estudio tiene como objetivos desarrollar una metodolgía analitica con las facilidades que se tienen de equipo de laboratorio y con el desempeño más confiable. Dos métodos fueron desarrollados y validados con de pruebas de rutina, muestreo "round-robin." Se describen en este estudio, el tratamiento histórico de los métodos desarrollados, de las pruebas y del muestreo.

Study of the Attack of Acidic Solutions on Melamine-Acrylic Basecoat/Clearcoat Paint Systems—W.R. Rodgers, D.P. Garner, G.D. Cheever

JCT, Vol. 70, No. 877, 83 (Feb. 1998)

The extent of penetration of an acidic solution into a melamine-acrylic coating, the bulk change in the thermal properties of the coating, and the chemistry and kinetics of acid degradation were investigated. Fluorescent microscopy experiments showed that significant penetration of the clearcoat occurs rapidly with acidic solutions. Thermal analysis of a matrix of samples exposed to a variety of conditions showed that significant differences occurred as a function of time, temperature, and acid concentration. Infrared analysis showed unreacted excess alkoxymethyl melamine was hydrolyzed first, followed by the hydrolysis of the crosslinks.

Acidic solutions are able to penetrate the coating in a short time. Once in the coating, chemical reactions occur which result in degradation of the crosslinked network causing a change in the thermal properties and the appearance of the coating materials. The reaction is hydrolysis of the crosslinks followed by either destruction or leaching of the crosslinking material.

heubach

ONE DISPERSION
AQUIS®
TWO USES

For a Bright and Colorful World

heubach

...COPY & FAX... COPY & FAX... COPY & FAX... COPY & FAX... COPY & FAX...

. . . for more Information & Samples

To heubach Fax-No. 1-215-736-2249

Heucotech LTD. 99 Newbold Road, Fairless Hills, PA 19030, USA

	AQUIS	Description	Information	Sample
PB-15	BW3521	Phthalocyanine Blue RS	☐	☐
PB-15:3	BW3571	Phthalocyanine Blue GS	☐	☐
PBlk-7	KW3720	Carbon Black	☐	☐
PBlk-7	KW3729	Conductive Carbon Black	☐	☐
PBlk-7	KW3750	Carbon Black	☐	☐
PG-7	GW3450	Phthalocyanine Green	☐	☐
PG-7	GW3454	Phthalocyanine Green	☐	☐
PG-36	GW3436	Brominated Phthalocyanine Green	☐	☐
PO-5	OW3270	DNA Orange	☐	☐
PO-16	OW3235	Dianisidine Orange	☐	☐
PO-43	OW3243	Antharaquinone Orange	☐	☐
PR-3	RW3125	Toluidine Red	☐	☐
PR-3	RW3126	Toluidine Red	☐	☐
PR-3	RW3127	Toluidine Red	☐	☐
PR-22	RW3191	Naphthol YS	☐	☐
PR-23	RW3140	Naphthol BS	☐	☐
PR-48:2	RW3170	Calcium Red 2B	☐	☐
PR-101	RW3100	Red Iron Oxide Light	☐	☐
PR-101	RW3105	Red Iron Oxide Medium	☐	☐
PR-122	RW3114	Quinacridone Magenta	☐	☐
PR-122	RW3116	Quinacridone Magenta	☐	☐
PR-166	RW3166	Disazo Scarlet	☐	☐
PR-170	RW3147	Naphthol Red F5RK	☐	☐
PR-179	RW3118	Perylene Maroon	☐	☐
PR-254	RW9111	Diketo Pyrol-Pyrol	☐	☐
N/A	RW3113	Diketo Pyrol-Pyrol	☐	☐
PV-19	VW3619	Quinacridone Violet	☐	☐
PV-23	VW3620	Carbazole Violet	☐	☐
PW-6	WW3000	Titanium Dioxide	☐	☐
PY-3	YW928P	Monoarylide	☐	☐
PY-14	YW3340	Diarylide AAOT	☐	☐
PY-42	YW3300	Yellow Iron Oxide	☐	☐
PY-74	YW811P	Monoarylide	☐	☐
PY-74	YW911P	Monoarylide	☐	☐
PY-74	YW968P	Monoarylide	☐	☐
PY-83	YW3310	Diarylide HR	☐	☐
PY-109	YW3352	Isoindolinone Yellow	☐	☐
PY-128	YW3328	Disazo Yellow GG	☐	☐
PY-150	YW3338	Nickel AZO Complex	☐	☐
N/A	YW3326	Monoarylide Blend	☐	☐

From Name . . . . . .

Company . . . . . .

Address . . . . . .

. . . . . .

Phone . . . . . .

Fax . . . . . .

12/97

Maximize Your Mexican Marketing Efforts and Let the Industry Come to You at the FSCT Co-Sponsored

1998 Panamerican Coatings Expo

July 23-24, 1998

World Trade Center

Mexico City, Mexico

The Federation of Societies for Coatings Technology is co-sponsoring with ANAFAPYT, the Mexico Paint and Printing Ink Manufacturers Association, the 1998 Panamerican Coatings Expo to be held on July 23-24, 1998 at the World Trade Center in Mexico City, Mexico. Mexico City's World Trade Center is a state-of-the-art facility and the newest location in Mexico City for hosting trade shows.

To date, the following exhibitors have reserved space in the 1998 Panamerican Coatings Expo:

Air Products & Chemicals, Inc.
Bayer de Mexico, S.A. de C.V.
BYK-Chemie USA
BYK-Gardner, Inc.
CB Mills
Connor Comercial, S.A.
Creanova Inc. (Hüls America)
Degussa Mexico, S.A. de C.V.
DJB S.A. de C.V.
DuPont, S.A. De C.V.
Eastman Chemical Co.
Eiger Machinery, Inc.
Fluid Management Inc.
Halox
Intertrade S.A. de C.V.
Metapol, S.A. de C.V.
Moca y Compania S.A. de C.V.
Netzsch Inc.
Quimica San Diego S.A. de C.V.
Reacciones Quimicas S.A. de C.V.
Shamrock Technologies, Inc.

For exhibit information, please contact FSCT Exhibit Management, Steve Kettelkamp, EMI, 10425 Old Olive Street Rd., Ste. 103, St. Louis, MO 63141-5940; Tel. (314) 994-9640; Fax. (314) 994-9650; or e-mail: expomanage@aol.com.

ICE LATINOAMERICA '98

A US-Latin America Coatings Conference & Exposition
April 15-17, 1998
Miami Beach Convention Center
Miami Beach, Florida

ICE Latinoamerica '98 will be held at the Miami Beach Convention Center, 1901 Convention Center Drive, Miami Beach, Florida. Miami Beach is the ideal location to serve the entire coatings industry for ALL of the Americas.

"Coatings for the Americas" is a two-day Coatings Conference Program that will explore the current state of environmental regulations, what their effects will be on Latin America industry and what the future may hold in this important area. The second part of the program studies what options there are in formulating regulatory compliant coatings and managing change in the R&D function to accomplish goals.

Attend the Expo and learn first-hand advancements in **Production Equipment, Raw Materials, Testing and Analytical Instruments, Specialized Services, Chemicals & Additives** that will help your company meet the new market demands.

Expo hours will be Wednesday, April 15—11:00 a.m. – 6:00 p.m.; Thursday, April 16—11:00 a.m. – 6:00 p.m.; and Friday, April 17—11:00 a.m. – 3:00 p.m.

Conference Program

"Coatings Across the Americas"—Tentative Program

Wednesday, April 15, 1998
9:00 AM - 12:00 Noon

ENVIRONMENTAL SESSION

This session will look into the future at what to possibly expect in regulatory issues facing the paint and coatings industry in Central and South America. The program is for company administrators and managers, technical directors and R&D managers.

Moderator: Jim Berry, Berry Environmental, Raleigh, NC

- **Company Perspective**
  Addresses how the Clean Air legislation has affected resin development, coatings formulation and possibly the manufacturing processes, in addition to providing some insight into how regulatory issues continue to frame the future of R&D programs.
  Speaker: Doug Wicks, Director of Research, Bayer Corp., Pittsburgh, PA

- **Existing Regulatory Framework**
  A review of the existing regulatory framework in the United States, focusing on recent legislative and regulatory developments and how they might have relevance for coatings companies operating in Central and South America.
  Speakers: Robert Steinwurtzel and Priscilla Whitehead, Swidler & Berlin, Washington, D.C.

- **Future Regulatory Perspective**
  A look into the future (five, ten and 25 years) to speculate on the impact of regulations on the paint and coatings industry. This talk will consider pending legislation and its potential effect.
  Speaker: Dick Wilson, Acting Assistant Administrator, Environmental Protection Agency, Washington, D.C.

Thursday, April 16, 1998
9:00 AM - 12:00 Noon

WATERBORNE COATINGS SESSION

This session will provide information on how to manage change in the R&D function to develop new waterborne coatings. This will also consider the advances in raw materials to formulate these coatings.

- **Formulating Waterborne and High-Solids Coatings**
  This presentation will address the practical issues related to the formulation of high-solids and waterborne coatings. Attendees will systematically review the proper methods and techniques to ensure a smooth operation from formulation to the actual coatings manufacturing process. Additionally, the environmental benefits of waterborne and high-solids coatings will be addressed.
  Speaker: Rich Johnson, Sierra Corp. and TK Products, Minnetonka, MN

- **Using Statistical Methods to Correlate Studies of Waterborne Finishes**
  Dr. Patel uses the example of durability testing to provide information on how statistical data analysis can assist companies in correlating testing results to actual performance. Waterborne finishes have presented particular correlation problems. Here, the use of statistical data analysis reveals limitations in correlating testing to actual performance. Dr. Patel discusses both the methods used in the study and analyzes the results, providing insight on how companies can reevaluate the tests that they currently employ.
  Speaker: Dr. Prashant Patel, BFGoodrich, Cleveland, OH

- **Next Generation Water Based Epoxy Systems**
  Waterborne epoxy resins have been used for a variety of applications in coatings for cementitious and metal substrates. This presentation will emphasize recent innovations in waterborne epoxy resin and amine-functional curing agent technology. Basic material characteristics and coating formulating information will be presented. Attendees will also learn the influence various formulation parameters have on the performance properties of coatings developed with these materials.
  Speaker: E.C. Galgoci, Shell Chemical Company

These companies are scheduled to exhibit their products and services in Miami Beach

Akzo Nobel Resins

Ashland Chemical Co.

BYK-Gardner, Inc.

CIBA Specialty

Corob North America

Creanova, Inc. (Hüls America, Inc.)

Eastman Chemical Co.

Ebonex Corp.

Eiger Machinery, Inc.

Falcon Chemical

Fluid Management, Inc.

Franklin Industrial Minerals

Gretag Macbeth

Halox

William Harrison Corp.

Heisler Industries

HERO Industries

Hockmeyer Equipment Corp.

Inmark, Inc.

International Specialty Products (ISP)

Italtinto S.r.l.

Kelly Chemical Corp.

Kenrich Petrochemicals, Inc.

King Industries

Ronnigen-Petter

Tikkurila, Inc. (Kemira)

Vorti-Siv, Div. of MM Industries, Inc.

Western Equipment Co.

Hotel & Travel Information

Call Travel Planners toll free at 1-800-221-3531 (In NY call 212-532-1660) or fax 212-779-6101 for special ICE Latinoamerica '98 hotel, airfare, and ground transportation discounts. *(Mention that event is in conjunction with Plasticos de las Americas.)*

HOTELS: (Rates *[single/double]* do not include taxes and are available only through Travel Planners, Inc.)

Hotel Inter-Continental Miami
100 Chopin Plaza, Miami
$139/$139

Doubletree Grand Hotel
1717 North Bayshore Drive, Miami
$109/$119

The Shelbourne Beach Hotel
1801 Collins Avenue, Miami Beach
$139/$139

South Beach Hotel
2201 Collins Avenue, Miami Beach
$105/$105

Sol Miami Beach Hotel
3925 Collins Avenue, Miami Beach
$99/$99 (City View)
$125/$125 (Ocean View)

Registration Information

To register in advance, complete the form below and fax (if paying by credit card) or mail (if paying by check) to:

FSCT, ICE Latinoamerica '98,
492 Norristown Rd., Blue Bell, PA 19422; Fax 610-940-0292

Registration Fees [T.]:
❑11 Regulatory/Coatings Conference ..... $295 (U.S.)
❑13 ICE Latinoamerica '98 Expo ..... (Free)

❑ Enclosed is Check #_____ payable in U.S. Funds on a U.S. Bank to "ICE Latinoamerica"

❑ Charge $ _____(U.S.) to the following card: ❑MC ❑VISA ❑AMEX

Card No. _____

Expiration Date _____

Signature _____

Please print Cardholder's Name _____

Please complete below infomation for badge.

Name _____

Nickname (for Badge) _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____ FAX _____

Please Check One Block in Each of the Two Columns Below:

Company [Z.]

1 ❑ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants, etc.
2 ❑ Manufacturers of Raw Materials
3 ❑ Manufacturers of Equipment and Containers
4 ❑ Sales Agents for Raw Materials and Equipment
5 ❑ Government Agency
6 ❑ Research/Testing/Consulting
7 ❑ Paint Consumer/Applicator
8 ❑ Other _____

Position [O.]

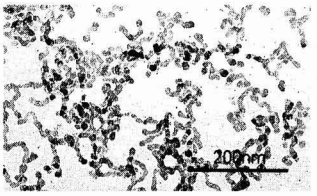
11 ❑ Management/Administration
12 ❑ Manufacturing and Engineering
13 ❑ Quality Control
14 ❑ Research and Development
15 ❑ Technical Sales Service
16 ❑ Sales and Marketing
17 ❑ Consultant
18 ❑ Other _____

for Binder ?
Micro Filler ? or ?

Magic

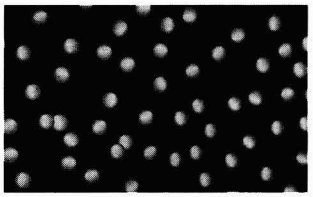
with

Silica sol!



ST-UP chain molecules of silica.
5-20nm in width
40-300nm in length

ST-O negatively charged small particle sol (ca. 12nm), not including anion and cation without stabilizing ion



Colloidal Silica dispersed in organic solvent.

Type	SiO_2%	Dispersant
MT-ST	30	Methanol
IPA-ST	30	Isopropanol
EG-ST	20	Ethyleneglycol
MEK-ST	30	Methly Ethyl Ketone
NPC-ST	20	Ethyleneglycol-mono-n-propylether

Particle Diameter 10-20nm.
Available product is much more.

NISSAN CHEMICAL INDUSTRIES, LTD.
— Chemicals Division —

Tokyo Head Office
Phone: 03-3296-8065 Telefax: 03-3296-8360
New York Office: Contact person: M. Matsumura
Phone: 914-332-4745 Telefax: 914-332-4808
http://www.snowtex.com

Circle No. 169 on Reader Service Card

FSCT Invites Nominees for 1999 Mattiello Lecturer

The Federation of Societies for Coatings Technology is seeking nominations for the 1999 Joseph J. Mattiello Lecturer. The Mattiello Lecture will be presented at the 77th Annual Meeting of the Federation, to be held October 20-22, in Dallas, TX.

The lecture commemorates the contributions of Dr. Joseph J. Mattiello, former President of the Federation, who was instrumental in expanding the application of the sciences in the decorative and protective coatings fields.

The Mattiello Lecture Committee will select a person recognized for outstanding contributions to science, technology, and engineering related to the coatings industry to present a paper on a phase of chemistry, engineering, human relationship, or other discipline fundamental to paint, varnish, lacquer, or related protective and decorative coatings. The Mattiello Lecturer shall embody the standards of technical accomplishment, service to the coatings industry, and leadership established by Joseph J. Mattiello.

All nominations for the Mattiello Lecturer shall include the following information:

- Name, age, and place of birth
- Current position and brief job history
- Education and degrees, with dates
- Brief reference to other significant awards
- Description and significance of accomplishments that are deemed to qualify the nominee for the award.

The items cited should be concerned with coatings, be pertinent or related to coatings, or be concerned with the constituents of coatings. Some activities and accomplishments which are considered to be appropriate for citation in the nomination are the following:

- Publication and communications such as the following:
  - — Journal articles
  - — Patents
  - — Books (authored, edited, or organized)
  - — Chapter in books
  - — Lectures and presentations
  - — Symposia or meetings organized

(Reprints may be submitted with the nomination but should be restricted to those that reflect seminal contributions; teaching credentials or skills, per se, are not to be considered in this award.)

- Inventions and discoveries
- New scientific principles, understanding or insight
- New or improved products
- New or improved instrumentation or testing methods
- New or improved analytical methods
- Novel uses or applications of products
- New or improved processes for production of resins or coatings, etc.
- Engineering aspects
- New or improved application methods

Please forward all nominations by May 1, 1998, to Patricia D. Ziegler, Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422-2350.

Federation of Societies for Coatings Technology

ice'98 = **International Coatings Expo**
FSCT Annual Meeting
Technology Conference

October 14-16, 1998
Ernest N. Morial Convention Center
New Orleans, LA

For more information, contact FSCT, 492 Norristown Rd., Blue Bell, PA 19422; Phone: (610) 940-0777; Fax: (610) 940-0292; Web: http://www.coatingstech.org

สังคมคุรุวิทยาศาสตร์บัณฑิต

New name, more service.

Hüls America Inc. became CREANOVA Inc. on January 1, 1998. As a Hüls Group company, CREANOVA Inc. will continue in the worldwide colorants and biocides businesses and the North American coatings raw materials and specialty chemicals businesses. Our customers can keep their service expectations and contact lists. They also can look forward to our responding even more efficiently to their needs. Call toll-free

1-888-661-SMPL

for a copy of the CREANOVA Inc. Profile and Product Guide.

A new name, ambitious goals, a firm foundation

CREANOVA
A Hüls Group Company

Circle No. 269 on the Reader Service Card

R&D Magazine Anticipates Resurgence in Funding for Research and Development

According to the annual forecast by Battelle, Columbus, OH, and *R&D Magazine*, the United States could be on the brink of a major resurgence in the funding of research and development.

The forecast predicts that R&D spending in 1998 will reach more than $215 billion, a 4.66% increase over the $206 billion that the National Science Foundation estimates was spent in 1997.

The prediction comes after years of stagnation in R&D spending. The increase signals a trend that is expected to last into the next century, according to Jules J. Duga, Battelle's Senior Analyst and the forecast principal author.

"Industry realizes that changes in operations and structure are not the only roads to profitability," said Mr. Duga. "Investment in research and technology is required for long-term survival."

Predictions for 1998 include:

✓ The federal government will contribute $62.9 billion to conduct R&D, slightly more than what was spent last year;

✓ Industry will invest $143 billion, an increase of more than six percent from 1997; and

✓ Universities and other non-profits will invest nearly $10.2 billion on R&D.

Before 1980, the federal government was the dominant supporter of R&D, funding more than 50% of the work. Since then, however, government's share has slipped to less than 30%, a figure that is expected to continue falling over the next five years.

The government supports R&D in all four performing sectors—federal laboratories, private industry, academic institutions, and other non-profits. However, the forecast predicts that only academia will enjoy increased funding, though the total will barely keep pace with inflation.

These trends in funding are consistent with the response to a recent *R&D Magazine* survey, where 50% of those surveyed expected funding to remain constant. The remaining 50% was divided evenly between those expecting slight increases or decreases.

While the industrial funding of R&D is expected to climb to 6.72%, the real increase beyond inflation factored at 2.6% will be about 4.1%.

"After a decade or more of downsizing and cost-cutting, American companies are shifting their attention to top-line growth," said Stephen M. Millett, a researcher and futurist at Battelle. "The great challenge of the future is to both grow sales and increase profitability. American companies would like to compete in customer satisfaction rather than lowest cost. So, they are investing more in R&D to realize significant improvements in the benefits provided to customers."

"Pharmaceuticals is a huge area of genetic-based ethical drugs. Micro-electronics is another area of intensive R&D. This trend moves with advances in telecommunications and computer technology."

The findings also show that other significant increases will occur in the areas of electronic components; medicine; scientific and mechanical measuring instruments; non-electrical machinery; office, computing and accounting machines; and motor vehicles.

"These sectors are high-intensity supporters of R&D," Mr. Duga said. "They will account for 50% of R&D funding, but only 33% of total sales."

Mr. Duga said industries that will see the smallest changes in funding include paper, petroleum refining, and industrial chemicals.

The overall increase in R&D funding could stretch well into the next decade, Mr. Duga said.

The 1998 Battelle-*R&D Magazine* was prepared by Jules J. Duga of Battelle and Tim Studt, of *R&D Magazine*. Special input was provided by *R&D Magazine* and the Industrial Research Institute. Other information was provided by the National Science Foundation, federal budget documents, the American Association for the Advancement of Science, Schonfeld & Associates, and other sources.

DuPont Automotive Survey Reveals Green and White as the Most Popular Exterior Vehicle Colors

During 1997, North American vehicle buyers selected green and white shades as the most popular exterior vehicle colors. However, according to the DuPont Automotive's, Troy, MI, Annual Color Popularity Survey, buyers are being drawn toward natural and high-tech colors, such as light brown metallic and silver. Interior colors, meanwhile, continue to be dominated by neutrals, such as gray and brown, according to a complementary study by Industrial Fabrics Association International.

In the truck/van category, white outdistanced green to remain the perennial favorite.

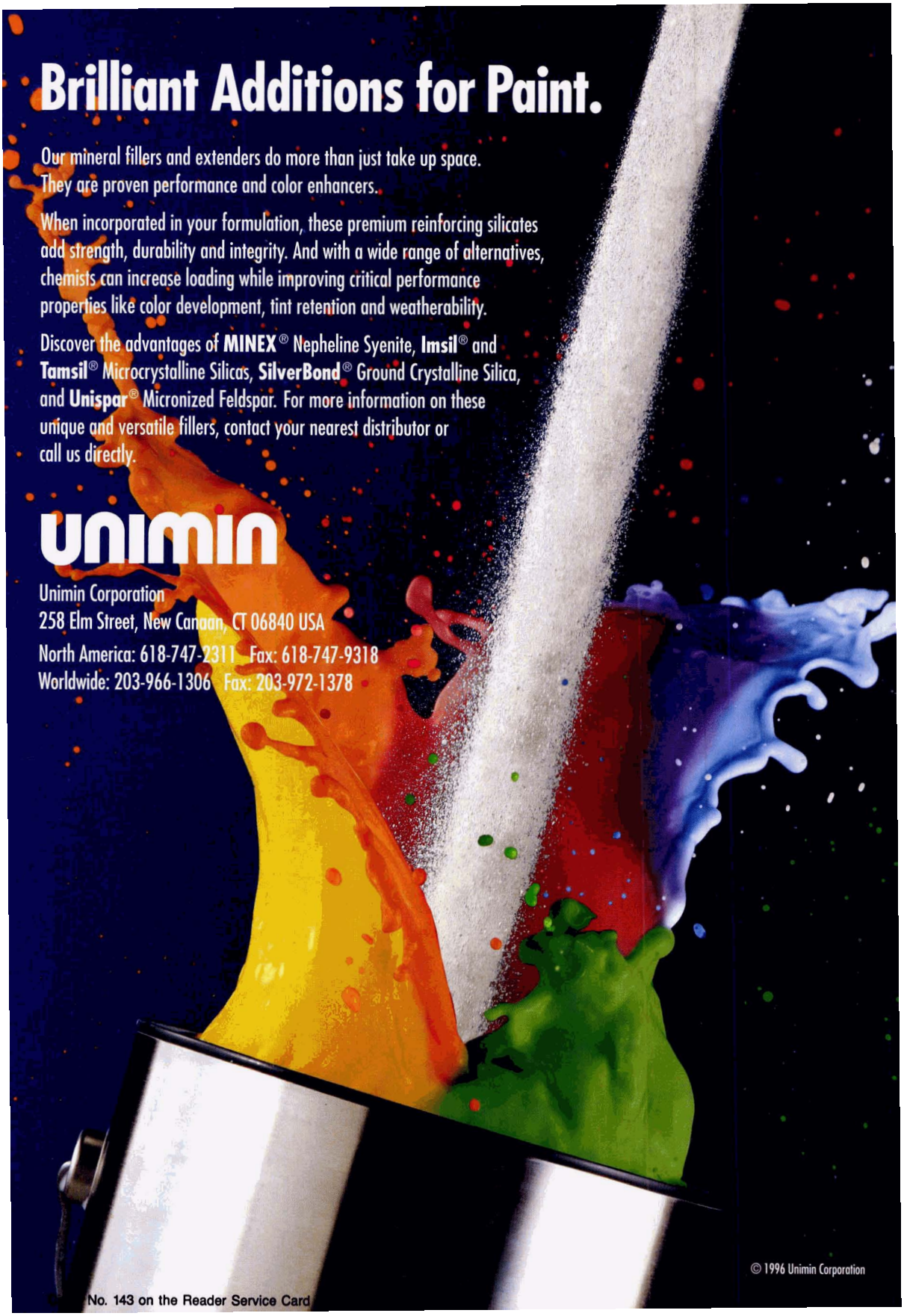
DuPont measures exterior vehicle color popularity in four segments—luxury, full/intermediate, sport/compact, and truck/van—as a baseline for predicting trends four to six years in advance of production. The 1997 results suggest that consumers increasingly will opt for earth tones with brighter hues and shades punctuated by colors that evoke high technology into the year 2000 and beyond.

Based on the survey, the following trends were reported. Light brown metallic has grown in popularity to lead the luxury car category, with green, black, and silver gaining on white. In the full/intermediate market, light brown jumped four percent gaining ground on the two leaders—green and white.

Green continued to dominate the sport/compact and full/intermediate categories, but lost footing to light brown, silver and red.

Overall, silver, one of the emerging "high-tech" colors, increased in popularity in three of the four categories, doubling in the luxury category. In addition, black, always a popular vehicle color, continued its trend toward a top-three color in all categories, most notably increasing in the luxury and truck/van (including SUV) categories.

At the same time, DuPont is tracking the popularity of interior complementing colors for a complete styling package. North American interior color choices from 1997 are: gray—42%; beige/brown—27%, blue—16%; red—six percent; black—four percent; green—four percent; and white, one percent.


Brilliant Additions for Paint.
Our mineral fillers and extenders do more than just take up space. They are proven performance and color enhancers.
When incorporated in your formulation, these premium reinforcing silicates add strength, durability and integrity. And with a wide range of alternatives, chemists can increase loading while improving critical performance properties like color development, tint retention and weatherability.
Discover the advantages of MINEX® Nepheline Syenite, Imsil® and Tamsil® Microcrystalline Silicas, SilverBond® Ground Crystalline Silica, and Unispar® Micronized Feldspar. For more information on these unique and versatile fillers, contact your nearest distributor or call us directly.
UNIMIN
Unimin Corporation
258 Elm Street, New Canaan, CT 06840 USA
North America: 618-747-2311 Fax: 618-747-9318
Worldwide: 203-966-1306 Fax: 203-972-1378
© 1996 Unimin Corporation
No. 143 on the Reader Service Card

Cleveland and Pittsburgh Societies Co-Sponsor 41st Annual Technical Symposium in April

The Cleveland and Pittsburgh Societies for Coatings Technology are co-sponsoring "Manufacturing Day" on April 22, and The 41st Annual Technical Symposium "Waterborne Coatings: Sink or Swim II" on April 23-24. Both events will be held at the Cleveland Airport Marriott, Cleveland, OH.

Manufacturing Day will begin with a tour of the ICI/Glidden plant in Huron, OH. After the tour, attendees will return to the Marriott where a presentation on the ever-changing manufacturing requirements in the coatings industry will take place.

The two-day technical symposium will feature presentations on the following topics:

Thursday, April 23

"Coating Application and Appearance: Surface Tension and Defect Control in WB Systems"—Joel Schwartz, Air Products and Chemicals, Inc.;

"Imparting Dimensional Stability with a VOC Compliant Water Repellent Technology"—Elaine M. Johler, Rhône-Poulenc;

"Formulating with Non-Toxic Corrosion Inhibitors"—Philip Peterson, Halox;

"Water-Dispersible Resin Technology for Low VOCs"—George E. Ahrens, Engineered Polymer Solutions; and

"Relevant Pretreatment Methods for Water-Based Coatings Systems"—Ramasubbu Sivhamar, Oakite Products.

In addition, the following two alternate speakers have been scheduled for Thursday:

"Evaluation of the Constrained Blister Test for Measuring Adhesion"—Mark Parsons, Case Western Reserve University; and

"A Novel Slurried Magnesium Aluminum Silicate"—Terrance P. Brennan, Southern Clay Products.

Friday, April 24

"Examination of the Hydrolysis of Waterborne Alkyd and Polyester Resins and the Practical Consequences for Paint Formulators"—Richard Marci, Ranbar Technology;

"Thin Films as Smart Coatings"—Jerome B. Lando, Case Western Reserve University;

"Introducing a New Line of Radiation Curable Oligomer"—Robert M. Zillioux, Reichhold;

"Foam Control Agents for Modern Waterborne Coatings"—Andrew A. Romano, Ashland Chemical Co., Drew Industrial Division;

"Selection and Performance of Organic Pigments for Water-Based Coatings"—Jim Delaney, Ciba;

"Using High Performance Two-Component Waterborne Polyurethane Wood Coatings"—Michael J. Dvorchak, Bayer Corp.;

"Driers for Waterborne Coatings"—Richard W. Hein, OMG; and

"Waterborne Acrylic Emulsions for Industrial Maintenance Coatings"—Homer Jamasbi, Rohm and Haas.

The following two alternate speakers have been scheduled for Friday:

"Polychlorotrifluoroethylene-Based Waterborne Coatings for Demanding Applications"—Thomas McCarthy, AlliedSignal; and

"Waterborne Polyurethane Coatings for Industrial Applications"—Charles R. Hegedus or Wiliam O. Buckley, of Air Products and Chemicals, Inc.

In addition, nearly 50 companies are expected to display their latest offerings for waterborne technologies in a New Product Showcase.

The fee to attend both symposia is $200. The one-day cost for Manufacturing Day is $65 while the fee for the Waterborne Coatings: Sink or Swim II is $150.

For more information, contact Vicki Fisher or James Currie, Jamestown Paint Co., 108 Main St., Jamestown, PA 16134; (412) 932-3101.

(See registration form on opposite page.)

NEW TOOLS
from Sartomer

New CD-570 Series chemical intermediates for coatings products

$$HO\,CH_2CH_2\left(OCH_2CH_2\right)_n\text{-}O\text{-}\overset{\overset{O}{\|}}{C}\text{-}\overset{\overset{CH_3}{|}}{C}=CH_2$$

New series of low toxicity alkoxylated HEMA (hydroxy ethyl methacrylates)

These versatile intermediates are excellent low toxicity, low odor replacements for HEMA.

They offer formulators variations in ethoxylation; CD-570 (2EO), CD-571 (5EO) and CD-572 (10EO). The CD-570 series imparts unique hydrophilic properties to resins or polymers for enhanced water solubility.

Call Sartomer Company for information, product samples, or technical assistance.

SARTOMER

1-800-SARTOMER (1-800-727-8663)

© 1997 SARTOMER Company, Inc., a member of Total group

Circle No. 168 on Reader Service Card

41st Annual Technical Symposium

Cleveland & Pittsburgh Societies for Coatings Technology Present

April 22, 1998—Manufacturing Day
April 23 & 24, 1998—Waterborne Coatings: Sink or Swim II

Cleveland Airport Marriott
Cleveland, OH

Registration Application

Please Print (for badge)

Name_____

Company_____

Address_____

City_____ State/Province _____ Postal Code_____

Phone Number _____ Fax_____

Registration Fees

Please check the programs you wish to attend.

Manufacturing Day (April 22, 1998) ..... $65.00 _____
Registration includes dinner ($75.00 after March 10th)

Please check one of the following dinner choices ❑ Chicken Mardi Gras ❑ Seaside Ravioli

Waterborne Coatings: Sink or Swim II (April 23 & 24, 1998) ..... $150.00 _____
Registration is limited to 200. ($190.00 after March 10th)
Registration includes two lunches, breaks, reception, and bound copy of the talks (including alternates).

Please check one of the following lunch choices:

Day one: ❑ Carved Roast Top Round of Beef ❑ Vegetarian Lasagna

Day two: ❑ Chicken Teriyaki ❑ Vegetarian Tortellini

Both Symposia ..... $200.00 _____
($250.00 after March 10th)

Total amount due $ _____

Make checks payable (in U.S. funds) to: **Cleveland Society for Coatings Technology**

Send registrations to: Jim Miller, Jim Miller & Associates, 3057 Kent Rd., Silver Lake Village, Stow, OH 44224-3850

Host Hotel: Cleveland Airport Marriott, 4277 W. 150th St., Cleveland, OH 44135; (216) 252-5333. Please make reservations directly and ask for the CSCT rate of $88.00. Complimentary airport transportation is available 24 hours.

Louisville Society's "Spectrum of Coatings 1998" Slated for April 15

Current formulating information and problem solving approaches for chemists, lab technicians, sales, marketing, and manufacturing personnel will be discussed during the Louisville Society's "Spectrum of Coatings 1998." Scheduled for April 15 at the Executive West Hotel, in Louisville, KY, this symposium will feature two concurrent sessions focusing on various topics including pigments, rheology, additives, instruments, resins, solvents, and manufacturing. The following topics will be discussed:

Room One

"Pigment Intermix Systems for Industrial Coatings"—Romesh Kumar, Clariant Corp.;

"New Chemical Modification Technology Offers Breakthrough in Black Pigments for OEM Coatings"—Mary Heithaus, Cabot Corp.;

"The Chemistry and Protection of Metal Surfaces from the Costly Effects of Electrochemical Corrosion"—Walter J. Conti Jr., Buckman Laboratories International Inc.;

"Analytical Sciences and Customers, Conundrums and You"—Keith Cannon, Red Spot Paint and Varnish Co., Inc.;

"Challenges of Obtaining an Alkyd Paint Rheology with Waterborne Latex Paint"—Mark Zody, Süd Chemie;

"Silicone Additives in Coatings Applications"—Lori Stark-Kasely, Dow Corning Corp.;

"Improved Paint Film Fungicide Performance with the Use of Potentiators"—Amanda L. Harkins, Buckman Laboratories International Inc.;

Room Two

"Crosslinker Blends in Two-Component Waterborne Polyurethane Coatings Systems"—William O. Buckley, Air Products;

"New Two-Component Wood Coatings Comprised of a Hydroxy Functional Acrylic Emulsion and a Water-Dispersible Polyisocyanate"—Vic Stanislawczyk, BFGoodrich;

"Veova Vinyl Esters for Latex Coatings"—Ed Hoozemans, Shell Corp.;

"Rapid Circulation Milling for Pigment Dispersion"—Herman H. Hockmeyer III, Hockmeyer Equipment Corp.;

"Zinger Mill Technology: Breakthrough in Media Acceleration, Distribution, and Particulate Reduction"—Mitch D. Newton and Stewart Rissley, Epworth Morehouse-COWLES;

"Principles of Filtration with Disposable Media and Filtration Management of Disposable Media"—Dan Koats, NorthEast Filter & Equipment Co.; and

"Filtering and Flow-Thru Principles"—John Edwards, Russell-Finex Inc.

The advance registration fee is $55.

Contact Ilona Nemes-Duvall, Red Spot Paint & Varnish, 1107 E. Louisiana St., Evansville, IN 47711; Phone: (812) 467-2337.

(See registration form on opposite page.)

Detroit Society's FOCUS Conference to Explore "Innovative Coatings" on April 21, 1998

On April 21, 1998, the Detroit Society will sponsor the 23rd Annual FOCUS Conference at the Michigan State University Conference Center, in Troy, MI. This year's event will address "Innovative Coatings: Practical Solutions for Global Demands."

The conference will feature two Keynote Speakers. Darlene Brezinski, of Paint & Coatings Industry Magazine will discuss "Driving Forces for Coatings Industry Globalization," and David Cole, of the University of Michigan, Transportation Research Institute, will present "Auto Industry of the Future: A World of Vanishing Boundaries."

Other presentations schedule for the two-track format include the following:

Track One

"Analytical Techniques to Measure Automotive Paint Film Degradation"—Trish Oberg, BASF Corp.;

"Catalysis of the Isocyanate Hydroxyl Reaction"—Werner Blank, King Industries, Inc.;

"The LEPC Powder Clearcoat Experience"—Mark Bindbeutel, GM Corp., Keith Gifford, Ford Motor Co., and Robert Mowers, Chrysler Corp.

"Two-Pack Polyurethane Coatings Systems for Plastic"—Claus Kobusch, Bayer AG;

"Scanning Probe Microscopy Investigation of Mechanical Properties of Polymer Coatings"—Weidian Shen, Eastern Michigan University;

"Aspects of Latex Film Formation"—Charles Kan, The Dow Chemical Co.;

"Globalization of Automotive Specifications"—Douglas Hart, GM Corp.

Track Two

"Phosphate Coatings: Basic and Practical Concepts"—Michael Petschel, Henkel Surface Technology Group;

"Key Attributes of Paint Filters"—James Schmitz, Parker-Hannifin;

"More Guidelines for Selecting Spray Equipment"—Jason Stevens, Universal Spray Technology;

"Current Status of UV-Curable Powder Coatings"—David Bargmann, Nutro Corp.;

"Filtration and Your Spray Booth"—Dan McNamara, Alar Engineering;

"A Universal Communications Network Serving the Paint and Coatings Industry"—Clarke Steigerwald, Midwest Information Systems, and William Mayhew and Matt Ahrends, Inspec, Inc.; and

"Comparison of Air Caps for Paint Atomizers by Air Volume and Velocity Profile"—John Moore, DuPont Automotive.

In addition, this year's FOCUS will feature a separate tutorial short course "Painting and Processing Plastics." The tutorial will cover processing techniques, key processing variables, processing problems, molding effects on paintability, adhesion principles, adhesion promotion, problems encountered in painting of plastics, chemistry of plastics additives, paint types utilized, and VOCs and HAPs regulations and considerations.

For more information, Contact Rosemary Brady, Akzo Nobel Coatings Inc., (248) 637-8565.

Louisville Society for Coatings Technology

"Spectrum of Coatings"

April 15, 1998

Executive West Hotel, Louisville, KY

What:

This symposium provides current formulating information and problem solving approaches for chemists, lab technicians, sales, marketing, and manufacturing personnel. By addressing some of the challenges facing the coatings professional, the symposium will focus on a broad range of topics including pigments, rheology, additives, instruments, resins, solvents, and manufacturing. There will be two lecture rooms for the morning and afternoon sessions. With such educational opportunity, everyone is assured a topic of pertinent interest. The 1998 "Spectrum of Coatings Science" symposium offers outstanding value for all individuals with technical backgrounds or interests.

When & Where:

April 15, 1998—8:00 am
Executive West Hotel, 830 Phillips Lane, Louisville, KY 40208; (502) 367-2251 or (800) 633-8723.

Speakers from:

Clariant Corp.; Cabot Corp.; Buckman Laboratories International; Air Products and Chemicals; BFGoodrich; Shell Corp.; Red Spot Paint & Varnish Co., Inc.; Süd Chemie; Dow Corning Corp.; Hockmeyer Equipment Corp.; Epworth-Morehouse COWLES; NorthEast Filter & Equipment Co; and Russell-Finex Inc.

Conference Application

Please Print

Name_____

Company_____

Address_____

City_____

State _____

Zip Code_____

Phone Number _____

Fax_____

Symposium Rates

The registration fee for the symposium includes continental breakfast, refreshments during breaks, and lunch.

❑ Attend Symposium ---------- $55.00 _____
($60.00 after March 31st)

❑ Attend LSCT Monthly Dinner Meeting ---------- $25.00 _____
($30.00 after March 31st)

Amount Enclosed $ _____

Make checks payable to: **Louisville Society for Coatings Technology**

Mail registration and check to: Chris Lockhart
American Dispersions, Inc.
P.O. Box 11505
Louisville, KY 40251-0505

For additional information, contact Ilona Nemes-Duvall, Red Spot Paint & Varnish, 1107 E. Louisiana St., Evansville, IN 47711; Phone: (812) 467-2337; Fax: (812) 467-2339.

Kansas City Society to Conduct One-Day Technical Symposium

A one-day symposium will be conducted by the Kansas City Society for Coatings Technology, on March 17, 1998 at Harrah's Hotel and Conference Center, North Kansas City, MO.

The following is the list of speakers and their presentations:

"Air Pollution Abatement and the Future of Coating Technology"—Frank Jones, Eastern Michigan University;

"Acrylate Ester Blends with Epoxies: Structure-Property Relationships in Amine Curing Systems"—Ron Cash, Henkel Corp.;

"Alkyd Chemistry and New Technology Trends in Coating Resin Synthesis"—Dennis A. Ryer, CCP;

"New High-Solids Melamine-Formaldehyde Crosslinkers for Lower Temperature Cure Coatings"—George Vaugh, Solutia;

"Today's Insight, Tomorrow's Innovations—One Package Crosslinking Finishes—Gail Pollano, Zeneca;

"Effects and Influences of Additives in Waterborne Coatings"—Markus Hoschke, Bayer Additives; and

"Compliant Solvents for Paints and Coatings"—Dan Skelly, Oxychem.

For more information or to make reservations, contact Yasmin Sayed-Sweet, CCP, P.O. Box 419389, Kansas City, MO 64141-6389; (816) 391-6190, or Dave Hazlett, Tnemec Co., Inc., 123 W. 23rd Ave., North Kansas City, MO 64116; (816) 474-3400.

Southwestern Paint Convention Slated for March

The 55th Annual Southwestern Paint Convention, sponsored by the Dallas and Houston Societies for Coatings Technology, is slated for March 25-27, 1998 at the Del Lago Resort and Conference Center, Conroe, TX. Entitled "New Nuts and Bolts to Keep Your Brushes Rolling," the conference will focus on new technologies and issues affecting coatings producers and their customers.

Serving as this year's Keynote Speaker is Sam Morell, of S.P. Morell and Co. He will discuss "The Role of the Raw Material Distributor to the Coatings Industry."

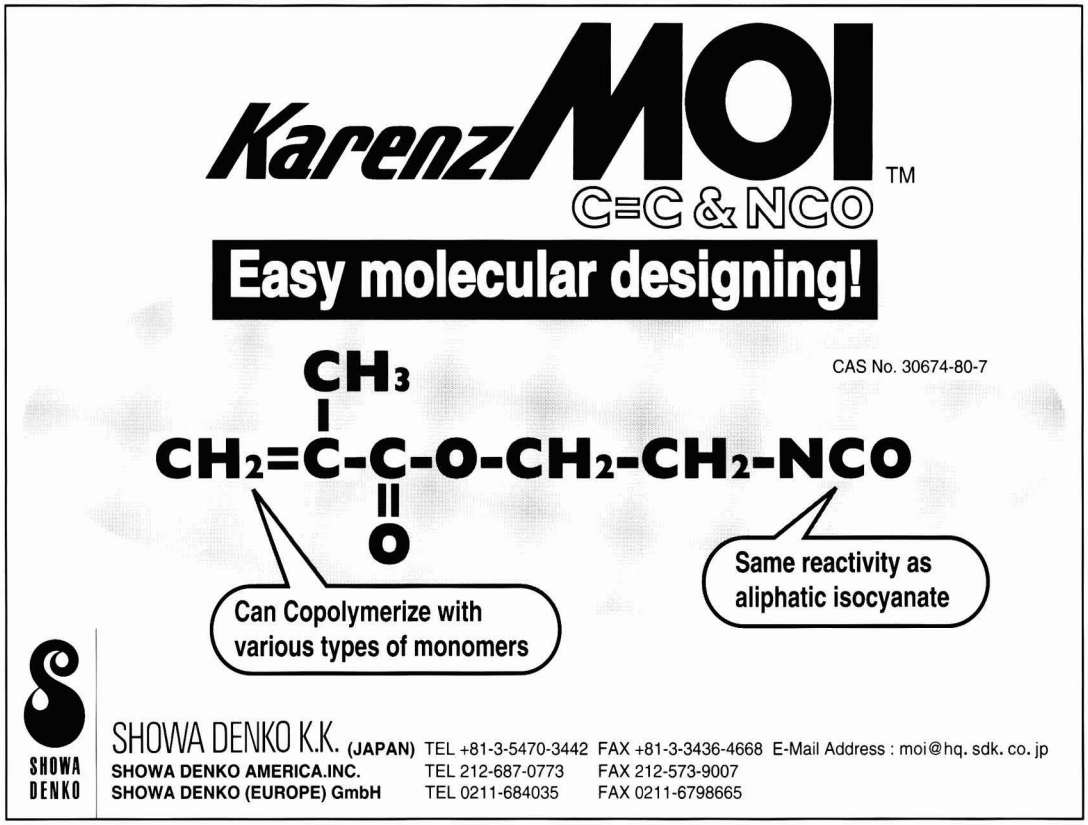
Technical programs will address new developments in raw materials, coating performance, and applied chemistries. A panel discussion on hazardous products liability will also be held.

In addition, various raw material and equipment suppliers will be exhibiting their product lines with table-top presentations. These exhibitions will take place on the Southern Empress, a paddle wheel boat, during a two-hour cruise.

Other activities during the convention include a suppliers reception, and a golf and tennis tournament. A spouses program is also being planned.

The registration fee for the three-day event is $125 and it includes the technical program, awards luncheon, and supplier reception.

For more information, contact Gary or Charmaine Phillips, c/o Picco Coatings, Inc., 11601 McKinley, Houston, TX 77038; Phone: (281) 447-8877.



Circle No. 257 on Reader Service Card

RadTech International UV/EB Processing Conference and Exhibition

Outshine the Competition!

April 19–22, 1998
Hyatt Regency Chicago
Chicago, Illinois

Ultraviolet (UV) and electron beam (EB) processing technologies are today's answer for increased productivity and profits, enhanced product performance and environmental compliance. Don't miss the world's largest conference and exhibition devoted to UV/EB processing, and learn how this rapidly expanding technology can give your company the competitive edge. More than 100 exhibitors of UV/EB equipment, materials and services will present the latest products and developments, including UV/EB coatings, inks and adhesives for an array of product applications. Applications sessions and technical presentations, along with a newly created poster session and a new-product debut session, will present valuable information to UV/EB newcomers and advanced professionals alike.

ninetyeight
RadTech
North America
CHICAGO

Sponsored by
RadTech International
North America

Contact: Chris Dionne
RadTech International
60 Revere Drive, Suite 500
Northbrook, IL 60062

Phone: 847/480-9576
Fax: 847/480-9282
E-mail: uveb@radtech.org
http://www.radtech.org

FSCT Publications

Publication Title	Item #	Member Price	List Pri
ACS Style Guide: A Manual for Authors & Editors	ACS-SG1	$26.95	$26.95
Basics of Technical Communicating	ACS-TC1	$36.95	$36.95
Benchmarking: The Search for Industry Best Practices That Lead to Superior Performance	ASQC-BSPI	$34.95	$34.95
Coatings Encyclopedic Dictionary			
Hard Cover	TV1-H	$105.00	$135.00
Soft Cover	TV1-S	$80.00	$105.00
Fluid Mixing & Gas Dispersion in Agitated Paints	MH-FM1	$73.00	$73.00
Functional Index Series - 3 Titles			
1. Index of Solvents	GOW-SO1	$150.00	$150.00
2. Index of Anti-Microbials	GOW-AM1	$150.00	$150.00
3. Index of Flame Retardants	GOW-FR1	$150.00	$150.00
Glossary of Color Terms	TV3	$12.00	$20.00
Handbook of Paint & Coating Raw Materials			
2-Volume Set	GOW-RM1	$425.00	$425.00
CD-ROM	GOW-RMCD1	$495.00	$495.00
Industrial Surfactants Handbook	GOW-IS1	$450.00	$450.00
Infrared Spectroscopy Atlas for the Coatings Industry	TV2	$150.00	$200.00
The Internet: A Guide for Chemists	ACS-IG1	$25.95	$25.95
ISO 9000 Guidelines for the Chemical and Process Industries, 2nd Ed.	ASQC-ISOG2	$27.00	$27.00
ISO 9000 Implementation for Small Business	ASQC-ISOSB1	$38.00	$38.00
Let's Work Smarter, Not Harder: How To Engage Your Entire Organization in the Execution of Change	ASQC-WS1	$26.00	$26.00
Paint & Coatings Testing Manual	ASTM-QC1	$220.00	$220.00
Paint Problem Solver	PDCA-PS1	$70.00	$70.00
Painting and Decorating Craftsman's Manual	PDCA-PD1	$140.00	$140.00
Pictorial Standards of Coating Defects	PS-CPM	$100.00	$100.00
Principles and Practices of TQM	ASQC-TQM1	$28.00	$28.00
The Quality Audit Handbook	ASQC-QAH1	$45.00	$45.00
Remedies for Common Paint Problems	PDCA-RP1	$50.00	$50.00
SciQuest	SCIQUEST	$750.00	$800.00
SPC Essentials and Productivity Improvement	ASQC-MA1	$35.00	$35.00
TQM: A Step-by-Step Guide to Implementation	ASQC-TQMI1	$39.00	$39.00
Understanding Chemical Patents, 2nd Ed.	ACS-CP1	$31.95	$31.95
Writing the Laboratory Notebook	ACS-LN1	$26.95	$26.95
FSCT Series on Coatings Technology			
Full Series	FS	$405.00	$675.00
Adhesion Aspects of Polymeric Coatings	FS26	$15.00	$25.00
Aerospace and Aircraft Coatings	FS14	$15.00	$25.00
Application of Paints and Coatings	FS9	$15.00	$25.00
Automotive Coatings	FS7	$15.00	$25.00
Cationic Radiation Curing	FS16	$15.00	$25.00
Coating Film Defects, 2nd Ed.	FS8	$15.00	$25.00
Coil Coatings	FS4	$15.00	$25.00
Color and Appearance	FS22	$15.00	$25.00
Corrosion Protection by Coatings	FS5	$15.00	$25.00
Film Formation	FS1	$15.00	$25.00
Finishing Exterior Wood	FS27	$15.00	$25.00
Free Radical Radiation Curing	FS2R97	$15.00	$25.00
Inorganic Primer Pigments	FS11	$15.00	$25.00
Introduction to Coatings Technology	FS15	$15.00	$25.00
Introduction to Pigments	FS19	$15.00	$25.00
Introduction to Polymers and Resins	FS3	$15.00	$25.00
Marine Coatings	FS12	$15.00	$25.00
Mechanical Properties of Coatings	FS6	$15.00	$25.00
Metal Surface Characteristics Affecting Organic Coatings	FS21	$15.00	$25.00
Methodologies for Predicting Service Lives	FS24	$15.00	$25.00
Organic Pigments, 2nd Ed.	FS10	$15.00	$25.00
Painting of Plastics	FS20	$15.00	$25.00
Powder Coatings	FS18	$15.00	$25.00
Rheology	FS17	$15.00	$25.00
Sealants and Caulks	FS13	$15.00	$25.00
Silicones in Coatings	FS25	$15.00	$25.00
White Pigments	FS23	$15.00	$25.00

FSCT Publications Order Form

Billing and Shipping Information

BILL TO

❑ FSCT MEMBER ❑ NON-MEMBER

Name _____

Title _____

Company _____

Address _____

City & State _____

Country _____ Postal Code _____

Phone _____ Fax _____

Your Position _____

Type of Company _____

SHIP TO (IF DIFFERENT)

Name _____

Title _____

Company _____

Address _____

City & State _____

Country _____ Postal Code _____

Phone _____ Fax _____

E-mail _____

Method of Payment

PLEASE CHECK ONE

❑ Charge to the following card: ❑ MC ❑ VISA ❑ AMEX ❑ DISCOVER Credit Card #: _____

Exp. date: _____ Name: _____ Signature: _____
(please print)

❑ My check # _____ is enclosed. ❑ My P.O. # is: _____

Order Form

QUANTITY	TITLE OF ITEM	ITEM #	COST	TOTAL

SUBTOTAL	
PA RESIDENTS ADD 6% TAX	
FOR U.S. SHIPMENTS OUTSIDE PA, ADD 5%	
FOR SHIPMENTS OUTSIDE THE U.S., ADD 8%	
TOTAL	

Please remit with your method of payment to:
Federation of Societies for Coatings Technology
492 Norristown Road, Blue Bell, PA 19422
Phone: (610) 940-0777 Fax: (610) 940-0292
http://www.coatingstech.org

FSCT Publications are also available through:
Jesus Camacho, ANAFAPYT, Gabriel Mancera 309,
Col. Del Valle, 03100 Mexico, D.F., Mexico

Control **Color:**

color-guide

The **new** *generation!*

The Future in Precision and Price

New technology revolutionizes color measurement: Calibration every 3 months, up to 10,000 readings per battery set and precise measurement results in seconds – at an attractive price.

Customized Color Control

Today Pass/Fail, tomorrow complex color analysis: You determine the functions of the **color-guide** for your specific application.

Documented Quality

Direct transfer of measurement results to Windows applications provides total flexibility for your documentation – be ready for ISO 9000.

color-guide ... grows with your needs.

gloss

color

BYK-Gardner offers the most complete product line for solving your measurement needs of color, gloss, haze, orange peel and physical properties – portable or benchtop.

BYK-Gardner – the total solution for the paint and plastics industry.

Use a color-guide for FREE!

Call (800) 343-7721 and ask for our free one week trial.

ISO-9001 BYK-Gardner

BYK Gardner INSTRUMENTS

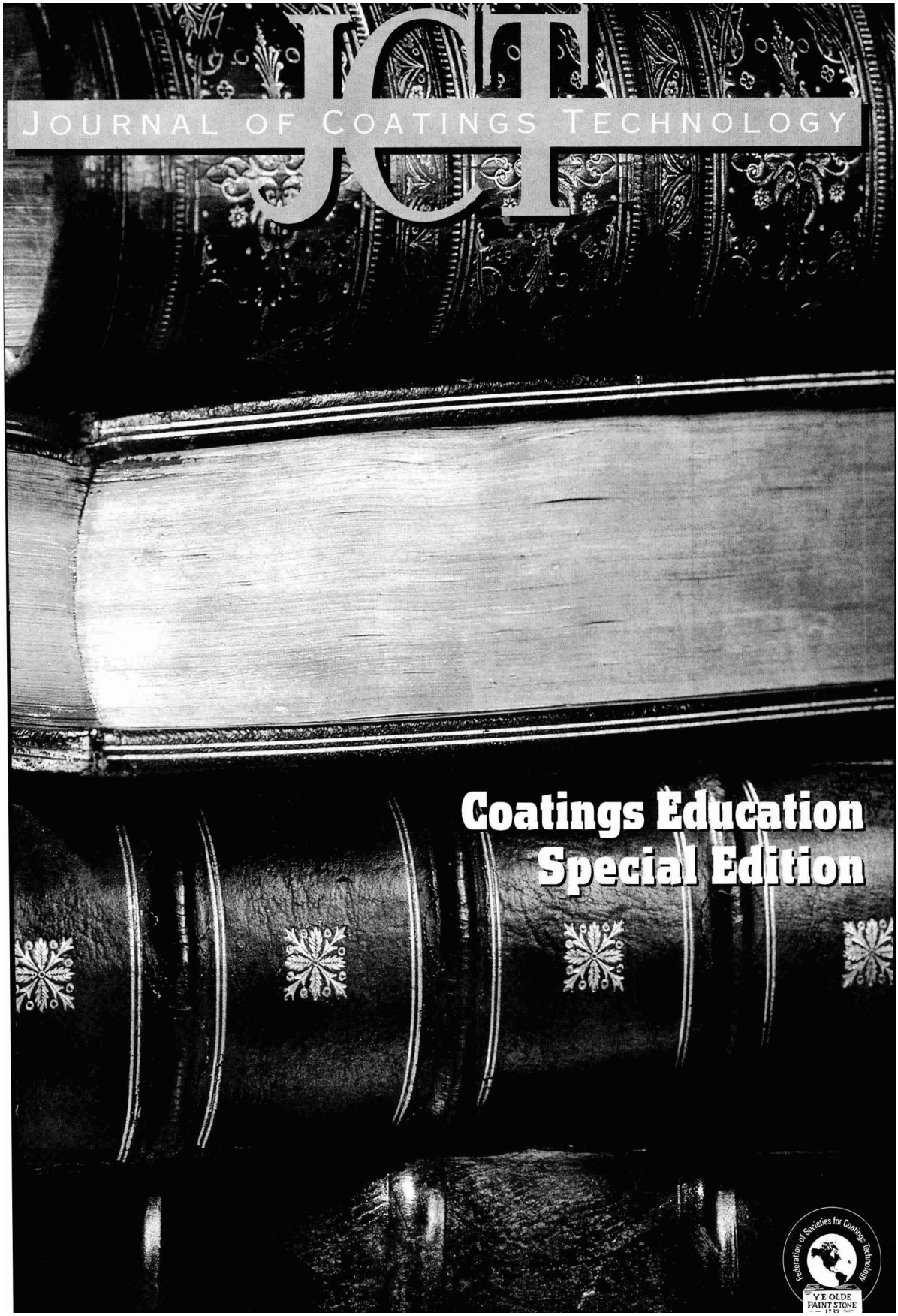
Please ask for information:

BYK-Gardner USA
RiversPark II, 9104 Guilford Road
Columbia · MD 21046 · USA
Phone 800 – 343 – 7721 or 301 – 483 – 6500
Fax 301 – 483 – 6555
http://www.byk-gardner.com

BYK-Gardner GmbH
Lausitzer Straße 8 · Postfach 970
D-82534 Geretsried · Germany
Telefon 0 81 71 / 34 93 – 0
Fax 0 81 71 / 34 93 – 40

Circle No. 264 on the Reader Service Card

JCT
JOURNAL OF COATINGS TECHNOLOGY



Coatings Education Special Edition

Educational Coordinating Committee Provides Benefits to FSCT Members

The FSCT Educational Coordinating Committee has been working to provide educational related benefits to the members, the industry, and future industry participants. It focuses its efforts on three main areas, Science Kits, the Distinguished Lecture Series, and the Small Society Scholarship program. These programs have been developed to enhance the educational efforts of FSCT.

Science Kits

In response to numerous requests from the Constituent Societies and the members, several years ago to FSCT Educational Coordinating Committee developed a Science Kit. The purpose of the Science Kit was to provide individuals with a tool to use when delivering information to school students and the like. After three plus years, there is still a large demand for this material.

The Science Kit consists of a series of experiments related to paints and coatings. The basic experiments are designed to be completed with materials that can be purchased in any building supply store. The experiments are also of a nature that will allow them to be completed in an average class time.

So far, over 300 Science Kits have been distributed to interested members. The Educational Coordinating Committee considers this resource a living document and it is continuously reviewing the effectiveness of the program and looking for new or improved experiments to add to add to the binder.

Distinguished Lecture Series

The FSCT Distinguished Lecture Series is designed to provide Constituent Societies speakers for the monthly meetings. Developed in 1995, the program consists of a team of speakers who are available to the Constituent Societies on an annual basis to give the Societies the opportunity to secure a speaker of national notoriety not otherwise available on the local level.

The results of the program have been very helpful in allowing the Societies to increase attendance at the monthly meetings and to bring out members who do not normally attend the monthly meetings. In the case of the Distinguished Lecture Series, it has accomplished both.

Participants in the Distinguished Lecture Series include Kenneth Hoy, of Allied Science Consulting, Sam Morrell, of S.P. Morell & Co., John Massingill, of Eastern Michigan University, and Richard Eley, of ICI Paints.

Small Society Scholarship

Since 1994, FSCT has provided over $20,000 in matching funds to Constituent Societies through the Small Society Scholarship Program. During this time, Societies have received funds for a variety of educational related programs, such as continuing education scholarships, Science Fair development, career fairs, college scholarships, and grants to colleges and universities.

Each year the Educational Coordinating Committee contacts the Societies in July with information on the program. The Societies can receive up to $400 in matching funds for each section of the organization.

For more information on these programs, contact Michael G. Bell, FSCT Director of Educational Services at (610) 940-0777. ◆*MGB*◆

FSCT Committees Focus on Educational Needs

The mission of the Federation is to provide technical education and professional development to its members and to the coatings industry. While these educational goals are central to all aspects of the Federation, we will focus here on the activities of several key committees—Educational Coordinating , Technical Advisory, Professional Development, and Annual Meeting Program.

Educational Coordinating

The FSCT Educational Coordinating Committee (ECC) monitors three activities that are very beneficial to the educational needs of the members. These three activities: the Small Society Scholarship Program, the Distinguished Lecture Series, and the Science Kit, are designed to provide resources for the members and Societies to assist and enhance the efforts at the local level. The ECC also conducts a one-day meeting for all Educational Committee Chairs to allow them to discuss the important issues that relate to Societies. This meeting also encourages interaction between representatives of Societies to share ideas on various projects and develop sources for future activities. Melinda Rutledge of the Los Angeles Society is the Chair of the Educational Coordinating Committee.

Technical Advisory

The Technical Advisory Committee (TAC) has created a new look to enhance its benefit to the Chairs of the Technical Committees at the Constituent Society level. The TAC held its yearly meeting with the Chairs but changed the entire format of the event to allow more interaction among the attendees. The TAC learned that Technical Committee role is changing on the Society level and responded with a meeting that will help the Societies meet the challenges of the future. In addition to these changes, the TAC continued to monitor

(Continued on page 31).

41st Annual Technical Symposium

"Waterborne Coatings: Sink or Swim II"

Co-sponsored by
Cleveland Society for Coatings Technology
and
Pittsburgh Society for Coatings Technology

April 23-24, 1998

Cleveland Airport Marriott
Cleveland, OH

Contact: Vicki Fisher, Jamestown Paint Co.,
108 Main St., Jamestown, PA 16134; (412) 932-3101

Coatings Industry Education Foundation

The future of any industry lies in the appropriate education of young people, both at the undergraduate and graduate levels. The Coatings Industry Education Foundation (CIEF) fosters this educational process for the coatings industry by raising funds and providing scholarships, fellowships, and grants to institutions of higher learning. This program not only benefits students and colleges or universities with a coatings curriculum, but it helps to sustain the long-term health of the coatings industry.

The objectives of CIEF are to further—through education and research—the knowledge and application of the chemical, physical, and mathematical sciences relating to the technology of protective coatings and to aid in the public dissemination of the results of such education and research through scientific publications and lectures.

"Project Tomorrow"

One of the most ambitious initiatives of the Coatings Industry Education Foundation is "Project Tomorrow," a funding program instituted in 1995 to support coatings education.

The first participant in this initiative, W.R. Grace & Co., presented CIEF with a check for $5000 at the 1995 FSCT Paint Industries' Show in St. Louis. The donation was given to assist the CIEF in supporting "the academic education of current and potential coatings scientists and technologists and the university programs that are active in coatings education and research."

Through "Project Tomorrow," CIEF acknowledges and publicizes the benefits of educating and training students *before* they enter the industry in programs such as those offered at CIEF-supported "coatings schools." CIEF trustees' evaluations have indicated that the students in these programs "are taught how to provide dynamic solutions to dynamic situations, *within the context* of the coatings industry, from the perspective of suppliers, manufacturers, and users. When they enter the workforce, they do so with their eyes open; consequently, they know coatings and enjoy the challenges of working with them."

The CIEF invites the industry to invest in the future through participation in "Project Tomorrow." This support is tax-deductible and participants will be acknowledged in all appropriate articles and press releases associated with the work of CIEF. Support categories and current partipants are noted in the accompanying article.

For additional information, contact Mary Brodie, CIEF President, c/o FSCT, 492 Norristown Rd., Blue Bell, PA 19422.

Funding for Coatings-Related Educational Institutions

To accomplish its educational objectives, the trustees of the CIEF review requests for fellowships, scholarships, research grants, and capital grants from institutions of higher education which are actively engaged in offering—or creating—a coatings program as part of their curriculum. Such requests must be submitted in writing to the CIEF Board of Trustees in the summer of each year by a deadline which is announced annually.

The funding requests must include at least the following information:

- Nature and scope of the college or university's current or planned coatings program;
- Type of students—for example, undergraduate, graduate, full- or part-time, etc.;
- Faculty credentials and teaching resources, e.g., laboratory and equipment;
- Targeted uses for CIEF support—for example, undergraduate scholarships, graduate fellowships, research, and/or capital grants, etc.;
- The selection criteria used in choosing recipients of scholarships and fellowships;
- Methods that will be employed for verifying the usefulness and effectiveness of the supported programs;
- Current employers of coating program graduates for the three previous academic years;
- Availability and amount of coatings program scholarships, fellowships, and grants provided by other sources.

After weighing all of this information and seeking any additional input which is necessary to arrive at a bal-

(Continued on page 34.)

"Project Tomorrow" Honor Roll of Donors

(donations through December 31, 1997)

FOUNDING CORPORATE SPONSOR

(Five-year commitment of $5000/year, beginning in 1995)

Grace Davison

CHARTER CORPORATE SPONSORS

(Five year commitment for $5000/year, beginning in 1997)

Crosfield Company

J.M. Huber Corp., Engineered Minerals Division

CORPORATE SPONSORS

(multi-year commitments)

Platinum Level	Gold Level	Silver Level
(annual gifts of $3000 or greater)	*(annual gifts of $1000 - $2999)*	*(annual gifts of $500 - $999)*
Akzo Nobel Coatings Inc.	Reichhold Chemicals, Inc.	Ribelin Sales, Inc.
	Ace Hardware Corp., Paint Division	Wayne Pigment Corp.
		The Flood Company

CORPORATE SUPPORTERS

(single year commitment)

Platinum Level	Gold Level	Silver Level
(gifts of $3000 or greater)	*(gifts of $1000-$2999)*	*(gifts of $500-$999)*
Duron, Inc.	SNCZ	Dow Corning Corporation
	Troy Chemical Corporation, Inc.	Elf-Atochem North America, Inc.
		L.V. Lomas Limited

PATRONS

(gifts up to $499)

Coatings Industry Honor and Remembrance Fund

In mid-1992, the Coatings Industry Education Foundation (CIEF) was proud to announce the establishment of the Coatings Industry Honor and Remembrance Fund, which is administered by the Trustees of the CIEF. The concept of an "Honor and Remembrance" fund was new to our industry, and was first suggested by 1993 FSCT President Colin Penny, who felt that many of us would like to honor friends, spouses, respected colleagues and outstanding employees in a public and substantive way. Colin felt that—by establishing a fund dedicated specifically to the honor and/or remembrance of those special people—the CIEF would be creating a meaningful and lasting tribute to their work. Since the intent of the Trustees is to use the earnings from the principal of this fund for educational assistance in the form of scholarships, fellowships, and grants to colleges and universities with coatings programs, anyone making a donation will also have the additional satisfaction of knowing that their gift will be used to help educate those who will carry on the tradition of scientific and technological excellence in the coatings industry—and who may very well be honorees of this same fund, someday.

By recognizing gifts to the Honor and Remembrance Fund in the JOURNAL OF COATINGS TECHNOLOGY, it is the Trustees' intent to give international recognition to both the donors and the honorees, as well as to focus on the educational benefits being derived from such gifts. This is a bold venture which will enable every individual, corporation, and society associated with the coatings industry to really "make a difference," by recognizing specific individuals' contributions to our industry, while furthering the educational efforts of the CIEF at the same time. Gifts in any amount (made payable to "CIEF—Honor and Remembrance Fund," and sent to the Federation Office) will be recognized annually in the JOURNAL OF COATINGS TECHNOLOGY, and will be divided into the following five categories:

- Gifts up to $249
- Gifts from $250-$499
- Gifts from $500-$999
- Gifts from $1,000-$9,999
- Gifts of $10,000 and greater

All gifts to the Honor and Remembrance Fund will be tax deductible to the extent that the law allows, and may be made as a direct gift to the Fund, as a gift in honor of a living person, or as a gift in remembrance of one who is deceased. Examples:

- The Acme Corporation
- The Ohio Coatings Society, in honor of Maynard Q. Browning
- Mr. and Mrs. Pierre M. Lundquist, in remembrance of John Z. Edwardson

It is currently the intention of the Trustees to reprint the list annually, with some indication of gifts which have been added since the last printing. The Trustees also placed a plaque, in 1994, in the Federation Office in Blue Bell, listing all donors of record, with sufficient room to add additional donors in the future. As of December 1997, the Honor and Remembrance Fund has received generous, and deeply appreciated, gifts from the following individuals:

The Coatings Industry Honor and Remembrance Fund

(Donations through December 31, 1997)

◆ Gifts of $10,000 and Greater ◆

Len and Neta Schaeffer, in remembrance of Fred and Ruth Daniel

◆ Gifts of $1,000-$9,999 ◆

Mrs. Herbert L. Fenburr, in remembrance of Dr. Herbert L. Fenburr

The Houston Society for Coatings Technology, in remembrance of Loren B. Odell

The Dallas and Houston Societies for Coatings Technology

John J. Oates, in remembrance of Elias Singer

The Chicago Society for Coatings Technology

Bonnie Johnson, in remembrance of Terryl F. Johnson

◆ Gifts of $500-$999 ◆

Akzo Coatings Inc. (Columbus), in remembrance of our employees who died in 1992

The Baltimore Society for Coatings Technology, in remembrance of our deceased members

The Baltimore Society for Coatings Technology, in remembrance of Richard D. McCloskey

The Kansas City Society for Coatings Technology, in remembrance of Terryl F. Johnson

The Cleveland Society for Coatings Technology, in remembrance of Fred G. Schwab and Helen Skowronska

◆ Gifts of $250-$499 ◆

Colin D. Penny

Saul Spindel, in honor of Sidney B. Levinson

*Hubert B. Williams, Jr. in remembrance of Leo Forth, Roy Landis, Ralph Gorman, Joe Coughlin, and Jack Goodyear**

◆ Gifts up to $249 ◆

The Birmingham Paint, Varnish, and Lacquer Club, in remembrance of Ray Howl and Ken Cooke

Sidney Lauren, in remembrance of Fred G. Schwab

Mr. & Mrs. George R. Pilcher, in remembrance of Helen Skowronska

Mr. and Mrs. Hiram P. Ball, in remembrance of Fred G. Schwab

Doris S. Schwab, in remembrance of Fred G. Schwab

Sidney J. Rubin, in remembrance of Ben Rubin

*New York Society for Coatings Technology**

*Gift received during 1997

Pittsburgh Society Emphasizes Careers and Scholarships

By Mark Harley, Pittsburgh Society for Coatings Technology

In the past, the Pittsburgh Society has supported education mainly at the University level by providing grants. However, this proved to be difficult to administer, since it was hard to have the students reapply because the amount offered was not large enough to compete with other scholarships.

In the late 1980s, this concept changed as the Society revised the programs. In the past, most of the efforts of the Society were directed to the universities. New committee participants evaluated the benefits of existing programs and made adjustments as necessary to move to other areas.

It was the consensus of the committee that the target should be junior and senior high school students. This took quite a bit of planning and adjustment. The going was rough at first, since many of the schools were resistant to have a group do a career talk to the students. The Pittsburgh Society used a Boy Scouts program, "Learning for Life" to visit many inner city schools to give talks on the merits of staying in school and the career possibilities that exist in the area of coatings technology for students.

The program has become more popular with each passing year.

One group that the Society worked with successfully was the Pittsburgh Regional Science and Engineering Fair. The positive working relationship enabled the Pittsburgh Society to provide one award to the list of outstanding paper awards, this one for the area of coatings. The first year there was one coatings related paper. As the number of papers has increased, the role of the Society has increased, and it now sponsors a larger award and also provides judges for the fair. This year there were three papers on coatings related subjects, and two received awards for their efforts. Again in 1998, the Society will be an active supporter of the fair.

One of the goals of the fair is to augment the participation from students from 370 to 600 by the year 2000. The Society hopes to continue to contribute and participate in the fair to see these goals become a reality.

As part of the switch to career-oriented programs, the Society has also become involved in "Program Hope," a career day program run by the Rotary Club of Pittsburgh. The program was targeted towards the inner city schools and has now been expanded to include both city and suburban schools. In the last four years, the program has grown from 1,000 students to between 7,000 and 8,000 in 1997 and is now held in the David Lawrence Convention Center in Pittsburgh.

Our final area of educational support is scholarship funding. The last five years, the Society has provided funding to Society members' dependents who are pursuing a degree in chemistry or a coatings related field of study. In May 1997 the Pittsburgh Society honored Hiram Ball, an FSCT Past-President, by naming the scholarship after him. It is the intention of the Pittsburgh Society to continue providing funds to students.

The Society has found its three-pronged niche in the area of education.◆

FSCT Committees Focus on Educational Needs

Continued from page 28.

the APJ/Voss Award competition and the Society Speakers Competition as part of the FSCT Annual Meeting. The Committee also took over the planning and judging of the annual Poster Session, conducted during the FSCT Annual Meeting. Cleveland Society member Fred Anwari is the Chair of the TAC.

Professional Development

The Professional Development Committee (PDC), under the direction of Chair Ronda Miles (Dallas), conducted three educational programs in 1997. In April, PDC sponsored the "Crosslinking for the Coatings Chemist: Understanding Crosslinking for Improved Performance," program in Orlando, FL. In June, the Committee presented "Practical Paint Formulation for Raw Material Suppliers" and "Winning Technical Presentations" in Philadelphia, PA. The Crosslinking program drew over 100 participants and the June program drew a combined total of over 70 attendees. The PDC also contributed the "Polymer Chemistry for the Coatings Formulator" program to the International Coatings Technology Conference, which attracted 95 attendees. Currently, the Committee is developing programs for 1998. During the coming year, PDC plans to run four programs: "Switching from Solvent-Based to Water-Based Coatings," "Rheology/Practical Rheology/Application," "Extender Pigments," and "Design of Experiments."

Annual Meeting Program

The Annual Meeting Program Committee built on the success of the initial International Coatings Technology Conference by expanding the offerings at the second Conference in Atlanta, GA. Plans are underway for the next Conference slated for October 11-13, 1998 in New Orleans, LA. The Committee, under the guidance of Suzanne Farnsworth, continues to bring high quality and timely technical and career related information to FSCT members and the industry. ◆*MGB*◆

Louisville Society for Coatings Technology presents

"Spectrum of Coatings"

April 15, 1998

Executive West Hotel
Louisville, KY

Contact: Ilona Nemes-Duvall, Red Spot Paint & Varnish, 1107 E. Louisiana St., Evansville, IN 47711; (812) 467-2337

Polymer Ambassadors—Reaching Students Through Teachers

By Gordon Hahn, Glasglow High School, Glasglow, MT

The Polymer Ambassador (PA) program was brainstormed on a napkin by high school teacher Melanie Stewart and elastomer chemist David Schultz over seven years ago. Its development began as a way to educate the general public about polymers. It was believed then, and still is today, that reaching teachers is one of the most cost effective ways of disseminating information about the development, production, concepts and use of polymers. Since that meeting, the informal ideas have evolved into a "formal" mission statement:

> *"The Polymer Ambassadors, with resources from educational, industrial and professional societies, promote polymer education with teachers, students and community audiences."*

The ambassador program is conducted and supported by the InterSociety Polymer Education Council (IPEC), a group consisting of representatives from the Society of Plastics Engineers, the Federation of Societies for Coatings Technology, The Society of the Plastics Industry, the American Plastics Council, the Polymer, Polymeric Materials and Rubber Divisions of the American Chemical Society.

Every PA is either a middle or high school teacher in a private or public school district, and the participants are awarded $3,000 each year as a means of fulfilling the mission statement. The funds are primarily used to purchase supplies for "kits" for teachers and to cover the cost of traveling to and running the workshops. Each PA has a formal term of three years, but some have continued on an informal basis after their terms have expired. The phrase "once a PA, always a PA" seems appropriate. The current PA's are from Montana, Illinois, Ohio, Missouri, Pennsylvania, New York, Kansas, and Georgia. In addition, in previous years PA's have come from Nebraska, Wisconsin, and North Carolina.

The most astounding aspect of the PA program has been the contacts and outreach. During the 1996-97 year alone, nearly 10,000 people nationwide attended a presentation put on by an ambassador. This number includes about 2,500 teachers who, in turn, take back what they learn to the classroom to an untold number of students, fellow educators and local communities. In the 1997-98 school year, it is estimated that the Polymer Ambassadors will make as many as 4,000 teacher contacts.

The types of presentations given by PA's vary a great deal. The most popular method is a workshop at local, regional or national science teachers conventions. In-service training at local schools, community programs, continuing education programs, NSF supported summer institutes, science museums, elementary school presentations and talks to professional or community organizations are other methods of presentation.

The workshops done by the Polymer Ambassadors cover a wide range of topics and venues. Each PA has his or her own "flare" and methodology as well as content covered. Some of the PA's are middle school teachers and offer material for younger aged students, including elementary children. Others gear their efforts towards the high school aged students.

Most of the PA's focus their discussions on thermoplastic chemistry and applications. Most of the presentations are "hands-on" with kits included that allow the participants to model how polymers are used in the world around them. One major emphasis of the PA program is to promote appropriate and correct science in the field of polymers. Some presentations are technical in nature and would apply to college prep chemistry courses. Others deal with consumer applications, history, natural versus synthetic polymers and environmental concerns.

Some of the Polymer Ambassadors have developed and written significant polymer teaching materials which have been in use in classrooms across the country since, and in some cases before, the inception of the PA program. Presently, they are working on a book aimed at middle school students which deals with industrial processing of thermoplastic materials. This book will include many hands-on manufacturing procedures and activities that simulate industrial activities.

The Polymer Ambassadors meet once or twice each year to assess the program, evaluate its goals, investigate problems and look for new ways to develop and distribute information about polymers. They work on new labs that use polymers and brainstorm new concepts that can be worked into existing school curricula. Rarely does a teacher have the opportunity to teach "just polymers," so the PA's are always working on ways to introduce polymers into their already full courses. This is always a challenge, but something the PA's are very adept at doing.

All of the teachers involved are superior master teachers with numerous years in the teaching field. Many have won such prestigious awards as the Presidential Award for Excellence in Science Teaching, Tandy Technology Awards, Catalyst Awards from the CMA, Excellence in Polymer Education Awards, and many others. They are hard working, dedicated educators who offer their expertise to help promote continued and varied forms of polymer education.

Organizations that support the PA program offer a means of educating the general populace about polymers in a way that would be impossible for industry to do alone. Most teachers do not have the personal resources, particularly the money, to travel and purchase materials for presentations. Local school districts certainly do not have the funds to support such an endeavor. The money that the PA's are awarded in this program makes their efforts feasible and very profitable. The PA program would not be a fraction of what it is today without their support. These ambassadors have been successful in educating teachers, students and communities about the vital role polymers play in our everyday lives in ways never dreamed possible when the program was first laid out on a napkin.♦

Dallas and Houston Societies for Coatings Technology present

55th Southwestern Paint Convention

"New Nuts and Bolts to Keep Your Brushes Rolling"

March 25-27, 1998
Del Lago Resort and Conference Center • Conroe, TX

For more information, contact: Eric Stoeber, Ribelin Sales Inc., 7786 Blankenship Dr., Houston, TX 77055; (713) 688-7722

Mentoring Relationships Help to Develop the Future Workforce

By Harvest Collier, St. Louis Society for Coatings Technology

Increasingly, technical industries are discovering the need to be more global in their efforts to stabilize their businesses and be more competitive in new national and international markets. For the coatings industry, as well as many other chemical related industries, a significant component of this stability is related to the development of its workforce. A growing concern is also the expectation that significant changes in the workforce demographics will result in an even greater competition among companies to attract productive and dedicated highly technically trained employees. What will likely become an increased activity for industries is their involvement in programs aimed at ways to enhance their workforce.

Many industrial human resource development efforts include various forms of mentoring and have long been employed as attractive ways to meet specific objectives in the life of businesses. Such strategies have been used both within and outside of companies to promote business interests and personnel development. For the coatings industry, a literally untapped resource for promoting interest in the industry and increasing the potential to identify and engage future employees in coatings technology may be available through mentorship approaches toward undergraduate and pre-college students.

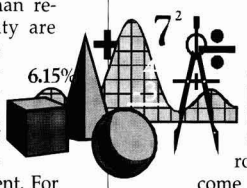
Although the role of a mentor may take a variety of emphases, there are some general characteristics that are common for most circumstances. From a fundamental perspective, a mentor is someone who takes an active role in a younger person's life, serving as a guide, coach, counselor, teacher, and friend who believes in and tries to help that person succeed. Recently, mentoring relationships have become more formal in many schools and businesses across the United States. These mentorship programs have focused on a variety of strategies including individual efforts, group efforts, or being a formal component of a company's human resource development program. What is consistently recognized is that it is a fundamental necessity for there to be a planned program with definitive objectives along with appropriate resources and people in order to implement an effective mentoring effort.

As part of the efforts to derive new strategies to meet the challenges of mentoring, industries have sought to develop mentoring association activities, professional association activities, networking activities, and even electronic communications as a means for enriching the quality of the work environment and the productivity of workers and perspective employees.

Many industries will need to begin examination of the growing issues of diversity related to mentoring in a multicultural society. The major issues in multicultural mentoring are the matching of cultural characteristics, the availability of free-choice mentoring, the influence of the institutional climate, the impact of institutional values and goals, and the influence of the operational theories of the organization and its members involved in mentoring. In order to mentor to diversity, a definition of what is meant by mentoring must be developed, the physical and social environments of organizations must be assessed in light of mentoring to diversity, and the structure of organizations and mentoring programs must reflect a multicultural orientation. Mentors can become multicultural people by learning more, confronting their own relational deficiencies, and learning to see reality from a variety of perspectives.

"The great diversity of science and math applications that exist in the area of coatings technology offers an opportunity for mentors . . . to fill an important gap in student learning."

One of the primary concerns that arises when considerations of implementing a formalized human resource development activity are made is the benefit that the activity will bring to the industry. For both the mentor or mentoring organization and mentee, the process of mentoring can lead to learning, growth, and development. For the organization, mentoring can enhance recruitment efforts, speed up the induction process, improve staffing plans, increase organizational communication, increase productivity and cost effectiveness, and improve the delivery of products and services. Mentoring maximizes the human capacity to form attachments, blends with many theories of how adults develop and change through life, enables people who might never have had the opportunity to communicate to learn from one another and to gain mutual understanding and respect, promotes the expression of talent, can productively utilize ideas that would otherwise have gone unnoticed, creates a valued place for highly experienced employees or retired workers, and could lead to the development of a society of self-directed and lifelong learners.



Without question, the business of effective mentoring can be an engaging undertaking that does not successfully conduct itself once a program is implemented. In many instances, the focus of mentoring efforts outside of the corporate environment must be geared to accommodate particular approaches to address community attitudes about the particular industry, the organizational mechanism utilized to most directly be engaged with a target population of youth as well as the specific objectives of the mentoring effort. In present-day society, there is a growing set of national problems that tend to characterize many communities, school districts and the attitude potential mentees have that, to a good degree, govern the effectiveness of these efforts. It has been clearly demonstrated that community orientated mentoring programs can constructively do much to counter growing national problems. Of great concern is the alarming and increasing numbers of youth who are steeped in hopelessness, engaged in antisocial and even violent behavior, and are on the verge of failure in school and adult life. Through effective mentoring, adult mentors can build student confidence; help students to overcome the fear of failure and the rejection of success; help students to take more responsibility for their own behavior; help students to develop creativity, persistence, and resilience; and develop positive adult bonds. Mentors can also help students to make the transition from the classroom to the workplace, become effective team members, learn technical skills and knowledge, design more suitable learning agreements, develop more realistic expectations and goals, and have more meaningful cooperative experiences.

Coatings industry professionals who participate in educational mentoring roles can beneficially serve both the industry as well as community pre-college and undergraduate students and teachers. The great diversity of science and math applications that exist in the

(Continued on next page.)

Mentoring Relationships

(Continued from previous page)

area of coatings technology offers an opportunity for mentors from the industry to fill an important gap in student learning by providing a bridge of practical knowledge and experiences between what students are exposed to in the classroom from textbooks and the realization of the application of science and math principles. Consequently, the mentor can communicate insight to students on the academic requirements needed for certain professional careers and serve as a resource for local school systems and teachers to reference science and math curriculum priorities to assist them in meeting their mission of appropriately educating students in a growing technical society.

FSCT's Constituent Societies may initiate mentoring projects by simply identifying one science or math teacher in a selected school to develop specific demonstrations, lectures or research / investigation projects or by establishing formal partnerships with all (or as many as desired) schools in a community to provide an organized documented program of lectures, demonstrations and projects aimed at assisting the teacher and informing students on the importance of science and math learning and how it relates to real-world professions.

One important requirement for serving as a mentor or organizing a mentoring program is that a definitive personal or group commitment of time and clear objectives for the effort be established before the project is initiated. Projects organized to work toward goals of, for example, generation of a resource booklet of coatings applications to demonstrate basic science or math principles, arranging a speaker series for community schools, providing a number of professionals to serve as advisors / technical assistants to teachers to support school-based research projects, or becoming a sponsor for school initiated projects are beneficial for providing students with enhanced learning experiences.

Other requirements may include tailoring mentoring activities to appropriately fit the population of students to be reached. For school systems in urban environments, for example, it may be necessary to have mentoring program components that address cultural experiences common to students in order to motivate them and gain their interest.

In addition to individual or coordinated industrial group efforts, the startup of a mentoring project may be accomplished through coordinated efforts with other community groups such as service groups, professional groups, specific school support groups and special emphasis educational programs that operate from a regional, statewide, or national base.

Such mentoring projects have been demonstrated to be very beneficial when conducted in an organized and consistent manner. The long-term influence of these efforts serve to promote the role of the industry in local community a long way toward orienting students about potential professional careers. ♦

The Detroit Society for Coatings Technology presents

The 23rd Annual FOCUS Conference

"Innovative Coatings: Practical Solutions for Global Demands"

April 21, 1998

Michigan State University
Management Education Center
800 East Square Lake Rd.
Troy, MI 48089

For more information, please contact: Rosemary Brady, Akzo Nobel Coatings Inc., (248) 637-8565.

Coatings Industry Education Fund

(Cont'd from Page 29)

anced decision, the Board of Trustees announces a decision to fund, partially fund, or decline the various proposals which it has received. These decisions reflect not only the quality of the proposals but also the anticipated, future value of the proposed program, given the current funding capability.

Requests for the academic year 1999-2000 must be received by the Trustees no later than June 15, 1998, and should be submitted to the President of the CIEF, c/o Robert F. Ziegler, Federation of Societies for Coatings Technology, 492 Norristown Road, Blue Bell, PA 19422-2350. All properly documented requests will be considered and a disposition sent to the originator by February 15, 1999.

In addition, the Coatings Industry Education Foundation administers the Joseph A. Vasta Memorial Scholarship in Coatings Science, and the Coatings Industry Honor and Remembrance Fund. *(See related article on page 30.)*

—Mary G. Brodie
President, Coatings Industry Education Foundation

Eastern Training Conference II and Show

Sponsored by
Philadelphia Society for Coatings Technology

May 11-14, 1998

Valley Forge Convention Plaza
King of Prussia, PA

Contact: Wayne Kraus, Hercules Incorporated, Research Center, 500 Hercules Rd., Wilmington, DE 19808; (302) 995-3435

Coatings Education

California Polytechnic State University, San Luis Obispo Undergraduate Polymers and Coatings Program

Cal Poly San Luis Obispo, one of the 21 campuses of the California State University system, enrolls over 16,000 students and is nationally recognized for the excellence of its programs in architecture, agriculture, engineering, and the sciences. The school maintains a history of graduating students with special abilities in applied fields. Extensive hands-on experience with modern instrumentation and equipment is a hallmark of the undergraduate education offered at Cal Poly/SLO. The polymers and coatings program was developed with the support of the Western Coatings Societies and particularly, the Los Angeles and Golden Gate Societies. These Societies, including the Pacific Northwest Society, provide financial support and equipment necessary for the coatings and polymers laboratory and provide internships and scholarships for students in the concentration. The Societies also provide guest speakers and help arrange field trips to appropriate companies several times a year. The Western Coatings/Cal Poly Foundation was developed to provide a means for individuals or companies to support the program financially. This foundation is a major source of support for the Cal Poly/SLO program. Requests from qualified industry and academic personnel to spend a sabbatical year at Cal Poly/SLO are most welcome.

This concentration provides educational and professional experience to chemistry majors who wish to specialize in polymers and coatings sciences, and to materials engineering majors who wish a background in polymers and coatings. The program meets the American Chemical Society requirements for certification as a chemistry/polymers degree. Two Cal Poly/SLO students are receiving scholarships sponsored by the LASCT. Twelve students are receiving scholarships supported by the Federation through CIEF. This year, our most outstanding polymers and coatings student, Bryan Lembo, was awarded the Ernest T. Trigg Scholarship.

The concentration includes five courses, including two laboratory courses, and comprises a total of 18 quarter units. An industrial internship, lasting from three to six months, is a central part of the program. Seven students took part in internships this past year. Companies participating in the internship program included Kelly-Moore Paint Co., Dunn-Edwards Corp., Rohm and Haas, Behr Process Corp., Allied-Signal Corp., and NuSil Technologies. Graduates completing the concentration will have the academic knowledge, technical training, and applied experience to enter the polymer and coatings industries. Students graduating last year accepted positions with a wide-range of companies, including Dunn-Edwards, Union Carbide and Kelly-Moore. Several of last year's graduates are continuing their studies at graduate school.

CAL POLY
CALIFORNIA POLYTECHNIC STATE UNIVERSITY

Industry-Related Research

Students and faculty are involved in a number of research projects in the coatings area, with co-sponsorship of industry. Several funded research programs are currently underway, including a study of the VOC profiles present in architectural and industrial maintenance aerosol coatings used in California, sponsored by the California Air Resources Board; a study of UV-cure resins for Rohm and Haas Corp.; and a study of novel powder coatings sponsored by the Powder Coatings Research Institute.

A one-week lecture and laboratory short course in basic polymer and coatings chemistry is planned for June 22-26, 1998. For further information on the polymers and coatings program at Cal Poly/SLO, please visit our WWW site at: http://www.calpoly.edu/~chem/pandc.html or contact Dr. Dane Jones, Department of Chemistry and Biochemistry, California Polytechnic State University, San Luis Obispo, CA 93407. Phone: (805) 756-2528; e-mail: djones@calpoly.edu.

Schools featured in this report are recipients of funding from the Coatings Industry Education Foundation.

DePaul University—Masters Degree in Coatings Technology

DePaul University is the center for graduate education in coatings technology in the Chicago area. The Master of Science program in Coatings Technology was instituted in the Department of Chemistry in 1986. The Chicago area has a high concentration of coatings companies. Akzo Nobel Coatings Inc., The Glidden Co., Rust-Oleum Corp., The Sherwin-Williams Co., and The Valspar Corp., among others, have manufacturing research and development facilities here. There is a continuing need in the Chicago area for chemists schooled and skilled in coatings technology to serve this industry.

The mission of the University's coatings program, which has been set

DePaul University

up with the cooperation of the Chicago Society for Coatings Technology, is to provide students with the skills necessary for work in research and development in the coatings field.

The main objectives of the program in coatings technology are twofold: (1) To satisfy the demand for technical professionals in the coatings industry at an advanced level, and (2) To provide an opportunity for Bachelor of Science level coating chemists in the Chicago area to enhance their knowledge and skill for improved levels of performance and advancement in salary and rank.

The program has a focus on graduate level (Master of Science). Mostly part-time students are enrolled (part-time/full-time student ratio is about 10/1). The program requires graduate admission to DePaul University through its College of Liberal Arts and Sciences. An Associate Dean serves as the Coordinator of Graduate Programs. This program in coatings technology is housed and administered in the Chemistry Department by Dr. Gregory Kharas. Candidates should have earned the Bachelor of Science degree in Chemistry or its equivalent. The 12-course curriculum will require about nine quarters of evening study.

The following full-time faculty are involved in the Coatings Technology Master of Science Program:

Physical Chemistry—Avrom A. Blumberg, Professor. B.S. 1949, Rensselaer, Polytechnic Institute; Ph.D., 1953, Yale University.

Inorganic Chemistry—Sanat Kumar Dhar, Professor. B.S. 1947, Calcutta University; M.S., 1959, Ph.D., 1961, Wayne State University. Postdoctoral Fellow, 1961, Northwestern University; Postdoctoral Research Assistant, 1962-64, Argonne National Laboratories.

Organic and Polymer Chemistry—Gregory B. Kharas, Associate Professor. M.S., 1968, Moscow Institute of Petrochemical and Gas Industry; Ph.D., 1981, Technion; Postdoctoral Fellow, Case Western Reserve University, Ohio 1982-1983; Postdoctoral Research Associate, University of Lowell, MA, 1983-1984.

Inorganic Chemistry—Sara Jane Melford, Associate Professor and Chair. B.S., 1964, Bowling Green State University; Ph.D., 1968, Northwestern University, NSF Post-doctoral Fellow, 1968, Rice University.

Organic Chemistry—Thomas Joseph Murphy, Professor of Chemistry. B.S., 1963, University of Notre Dame; Ph.D., 1967, Iowa State University. N.I.H. Postdoctoral Fellow, 1967-68, Ohio State University.

The following equipment is used in instruction related to the coating program: Brookfield viscometers models RVT and LVF; fineness of grind gage; wet film gages; film applicators; Sward hardness rock; Zahn viscosity cups; B.K. drying recorder; cone and plate viscometer; HunterLab color and color-difference meter model D25D; FT-IR spectrometer 1710 (Perkin Elmer); FT-IR spectrometer 1600 (Perkin Elmer); UV-Vis spectrometer (Beckman); DSC-TGA (Polymer Laboratories Inc.); HPLC with UV, IR and conductivity detectors (Spectra Physics); GC-MS system (Hewlett Packard); QTest I computerized mechanical tester (MTS Systems Corp.); and gel permeation chromatograph (Millipore)

Resources of the rest of the College of Arts and Sciences and the University as a whole are available to provide support in areas ranging from computer usage and statistical design to on-line library searches.

Since coatings systems are complex combinations of polymers, pigments and other chemicals, the course of study involves most branches of chemistry including organic, polymer, physical, inorganic and analytical chemistry. The program courses include: a minimum of 44 quarter hours, including any five from this set of six (substitutions, with other 300 or 400 level chemistry courses, may be made with permission of the chair):

(Course; Frequency; No. Students)

—CHE 422, 424 Adv. Inorganic Chemistry I,II; Annual; 15-20

—CHE 450, 452 Adv. Organic Chemistry I,II; Annual; 15-20

—CHE 470, 472 Adv. Physical Chemistry I,II; Annual; 10-15

—CHE 430 Polymer Synthesis; Biannual; 10-15

—CHE 432 Physical Chemistry of Polymers; Biannual; 15-20

—CHE 434 Polymer Characterization; Biannual; 15-20

—CHE 460 Coatings Technology I; Biannual; 10-15

—CHE 461 Coatings Technology Laboratory I; Annual; 5-10

—CHE 462 Coatings Technology II; Biannual; 15-20

—CHE 463 Coatings Technology Laboratory II; Annual; 10-15

About 25 students are participating in the program. All students in the Coatings Technology Program are graduate students, enrolled in the Master of Science Degree Program. Most students in the program are part-time students.

During the past academic year, the program was funded by DePaul University. CIEF has generously contributed funds for a graduate fellowship and equipment, which were matched by the DePaul University.

Any fellowship monies received by DePaul University are awarded according to demonstrated financial need and academic merit. The Office of Financial Aid will assist the Chemistry Department in determining need; the Chemistry Department will determine the academic merit of fellowship applicants.

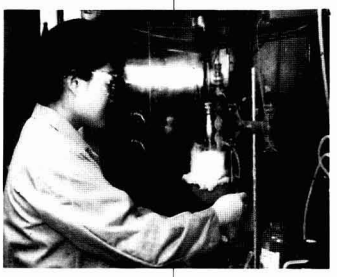
The Coatings Technology Program at DePaul University has received the endorsement and active support of the Chicago Society for Coatings Technology (CSCT). The department works closely with the CSCT Education Committee to assure relevancy of the program and provide assistance ranging from technical information to job placement.

DePaul graduates are highly competitive on the open job market, all students having secured positions well in advance of graduation.

For further details, contact Dr. Gregory B. Kharas, Chemistry Department, DePaul University, 1036 West Belden Avenue, Chicago, IL 60614; (773) 325-7367; Fax: (773) 325-7421

Eastern Michigan University Offers Instructional Programs at Undergraduate and Graduate Levels

The polymers and coatings curriculum at Eastern Michigan University is designed to provide an education and the background necessary for graduates to find employment in research and development laboratories of companies that manufacture paints, coatings, rubber, plastics, polymers, adhesives and inks, or in companies that manufacture raw materials for these industries. Today, Eastern Michigan University's Polymers and Coatings undergraduate and graduate programs of study continue to be a leader in the country in graduating the greatest number of quality students for the coatings industries. During the 1996-97 academic year, the undergraduate program of study graduated 27 students, all of whom found successful placement in industry. Each graduate received numerous job offers with an average starting salary of $35,200. The Master of Science Degree in Polymer Technology also had a placement rate of 100%. Graduates of our advanced degree in Polymer Technology can earn over $45,000 annually; most of them obtain positions of mid-management level responsibility within the coatings industry.



The University's Polymers & Coatings Technology programs provide quality educational opportunities and research for the coating technology industry. Faculty members with extensive research and industrial experience are employed to teach in the program and provide a solid content base for the program. Strong instructional programs are offered at the undergraduate and graduate levels and research efforts are guided by effective industrial input through industrial advisory committees.

The Polymers & Coatings Technology programs focus on three principal goals: (1) To educate and prepare graduates to join coatings industry oriented companies and become productive on the day they begin their employment; (2) To establish and propagate a strong cooperative education program to help students financially and allow them to gain valuable industrial experience; and (3) To provide a research experience through the Coatings Research Institute for undergraduate and graduate students in the programs.

New Faculty within Polymers & Coatings Technology

Over the past year, several significant personnel changes have occurred within the polymers and coatings faculty at Eastern Michigan University. Dr. Taki Anagnostou, Professor and Program Coordinator for both the undergraduate and graduate programs, has retired, effective June 1997. He will continue University involvement on a reduced level as an Emeritus Professor. New faculty hired this year are Dr. James Woo and Dr. Jamil Baghdachi.

Dr. Woo is a recognized expert in Polymers Synthesis and Characterization for industrial coatings and plastics. He received his Ph.D. degree in Organic Polymer Chemistry from the University of Maryland in 1967. He currently holds 31 patents and 28 publications in polymer synthesis and various industrial coating applications. For the past 15 years, he had been a senior scientist at the ICI-Glidden Co. in Cleveland, where he had been responsible for resin syntheses and characterization for industrial coatings used for a variety of applications including packaging, powder applications, appliance finishing and automotive finishing.

Dr. Baghdachi has also joined us as a researcher and faculty member. Jamil comes to us after 15 years working in industry, most recently being a senior group leader in OEM Coatings for BASF. At BASF, he had the responsibility for managing group activities and product development, application and customer service of automotive OEM coatings. He received his Ph.D. in organic chemistry from the University of Mississippi. Dr. Baghdachi holds over 18 patents and is the author of two technical books, four training manuals and co-author of other textbooks dealing with paint technology. Dr. Baghdachi has conducted workshops at regional and national universities in coating science and technology, color technology, adhesion and durability of coatings, corrosion prevention and adhesive bonding technology.

John Massingill, the current Director of the Coatings Research Institute, will assume the acting Co-Directorship of the National Science Foundation Center this year while Frank Jones, our senior faculty member in Polymers & Coatings Technology, prepares the second edition of his textbook entitled *Organic Coatings: Science & Technology.* This second edition will be reorganized and completely revised to update it with many of the new developments since the two-volume first edition was written in 1988 and 1993. The two volumes will be combined into one. Publication in 1999 is planned.

Frank Jones was awarded a half-time research fellowship from Eastern Michigan University for the 1997-98 year to write the second edition. Frank will continue to maintain an active research program during the 1997-98 academic year. Currently topics of research include solventless industrial coatings, mar resistant auto paints, the analysis of surface mechanical properties of polymers, and analysis of the uses of soybean oil in coatings and the synthesis of non-nano particle size latexes. He is currently collaborating with Professor Weidian Shen of the Department of Physics on the use of scanning probe microscopes to characterize surface marring and with an adjunct professor, Dr. John Gardon, on emulsion polymerization to make crosslinkable latexes. This year, Eastern Michigan University gave Frank Jones its Distinguished Faculty Award for Scholarly/Creative Activity. This recognition was a major highlight in his career.

Other new faces within Polymers & Coatings Technology at Eastern Michigan University include Dr. John Gardon, recently of Akzo Nobel, Mark Hedstrom, Executive Director of PRA

Labs, Paul Ziemer, the Emulsion Polymer group leader of PRA, and William Longley. They have joined our faculty as adjunct professors to bring contemporary industry-oriented courses to our undergraduate and graduate students.

Coatings Short Courses

Coatings Research Institute of Eastern Michigan University is offering a series of technical short courses ranging from two to three days beginning March 1998. The scheduled courses will be taught by the Coatings Research Institute's faculty and industry representatives. Some laboratory visits and hands-on work is included in these technical courses.

The first in the series is a course entitled "Durability and Performance of Coatings." The course will cover facts and findings impacting permanence and performance of coatings. Topics such as corrosion, adhesion, surface pretreatment, methods of enhancing durability and performance as well as service life prediction will also be discussed. The course is scheduled for March 24-26, 1998.

"Coating Defects, Causes and Prevention" has been scheduled for April 21-22, 1998. Reportedly, the course will discuss and present factors contributing to coating defects, their characterization techniques and methods of prevention. Defect resistant formulation as well as application techniques will also be discussed A half-day laboratory visit and problem resolution is included in the two-day course.

"Coatings for Plastics" has been scheduled for April 29-30, 1998. Formulating guidelines for low VOC high solids, waterborne, UV curing and powder coatings will be discussed. Application/processing conditions and surface preparation methods leading to durable defect-free coatings will also be discussed

In a three-day "Powder Coating" course, attendees will become familiar with powder coating resin chemistry, formulation, and application techniques. All segments of the industry from automotive to general industrial and packaging will be featured. The course has been scheduled for May 5-7, 1998.

"Waterborne Coatings," the last in the series, has been scheduled for May 12-14, 1998. The course will discuss and present a complete overview of current water-based resin chemistries, new findings and methods. Formulation guidelines for major paint markets including automotive, architectural, general industrial, and trade sales, will be presented.

All courses will be held in Eagle Crest Conference Center, Ypsilanti, MI. Ypsilanti is located approximately 15 miles west of Detroit Metropolitan Airport and near Ann Arbor, the home of University of Michigan. For more information, contact Series Director, Professor J. Baghdachi at (313) 487-2203.

Federation of Societies for Coatings Technology

Presents

ICE '98—FSCT Annual Meeting and International Coatings Expo and Technology Conference

October 14-16, 1998

Ernest N. Morial Convention Center
New Orleans, LA

For more information, contact
FSCT, 492 Norristown Rd., Blue Bell, PA 19422
(610) 940-0777; Fax: (610) 940-0292; Web Site: http://www.coatingstech.org

University Industry-Government-Academia Synergism at North Dakota State University

Many coatings chemists and coatings industry personnel know that the Department of Polymers and Coatings at North Dakota State University goes back to 1904–1906 when, in Fargo, the first paint chemistry course was offered as part of the chemistry curriculum, and grants from Sherwin-Williams, Glidden, ADM, General Mills, and other companies were pouring into the program. These "historical grants" set a tone for the present status of the department; and a time-long tradition created a seed for establishing the Department of Polymers and Coatings (1971). Today the Department of Polymers and Coatings represents the National Science Foundation Industry/University Coatings Research Center, and activities at the undergraduate and graduate levels are booming. In the last decade or so we have graduated well over 100 M.S. and Ph.D. students, who today have a significant impact on the direction and future of coatings science and coatings businesses. These contributions are affecting not only national education, but also the global economy.

The first-and-foremost involved activity for the faculty, graduate students, postdoctorates, and staff of the Department of Polymers and Coatings is the National Science Foundation Coatings Research Center. Currently, the Center is a consortium of three universities–North Dakota State University, Eastern Michigan University, and Michigan Molecular Institute, with 17 member companies.

The Center's two-fold mission is to be a leading academic organization that develops relevant scientific knowledge for understanding and expanding the technology of paints and coatings for the benefit of its members and to enlarge the cadre of scientists and technologists capable of working effectively with coatings. The overall objective of the Center is to provide scientific knowledge that will help its member companies with future challenges. Center programs are designed to complement the members' in-house research and development. Current scientific and technological objectives are grouped within the Center's core competencies:

– To demonstrate new concepts in polymer synthesis and crosslinking.

–To learn principles of the physical phenomena that are critical to coatings technology.

–To improve characterization methods for coatings.

–Low-cost involvement with a portfolio of research projects.

– Rapid information transfer through frequent reports and semi-annual meetings.

–Company/organization employee development by direct participation in I/UCRCC research.

–Preferential access to know-how and patents.

–Opportunities for informal consultation.

–Access to specialized equipment.

The research program is currently focused on the following six areas, which have been selected on the advice of the I/UCRCC Industrial Advisory Board: rheology and application; crosslinking; analysis and characterization; adhesion; corrosion; and design and modeling.

Environmental compliance is an over-arching objective of research in all six areas. Twenty specific projects in these focus areas have been funded, of which 13 are active and seven have been completed. Additional projects will be added as capabilities grow and new members are added.

NDSU

The department has developed a range of interactions with the coatings industry. The focus of many of these relationships is the department's Industrial Advisory Board. The IAB committee meets annually with the department in Fargo. Together they bring a broad range of backgrounds to bear on departmental issues. The IAB reviews and makes recommendations on the Polymer and Coatings program curriculum, thereby not only helping with technical trends in the field, but bringing to the forefront student needs and quality of their preparation for future employment. Successful industry-academic-government relationships are not possible by holding a sterile meeting for a day or two. A vital, extensive, and integrated program that affects everyday activities is the key to the NDSU Polymer and Coatings program. While there is still room for improvement, the industry-university-government interactions provide major benefits to industry, the university, state and national economy, and our students.

While graduate education and research represent one level of activity, undergraduate education has always been one of the top priorities at NDSU. Enrollment in coatings courses increases steadily, and one of the major attractions to undergraduates is our scholarship program that exceeds $40,000/year. Faculty and students are grateful to the scholarship sponsors: Coatings Industry Education Foundation; ICI Paints North America; PPG Industries, Inc. (supporting Donald P. Hart and Frederick M. Loop Memorials); Ira R. Messier Award; George A. Nichols (endowed by DeSoto); Northwestern Society for Coatings Technology; Carlton L. Rydstrom Memorial; Tnemec Company and its representatives supporting the Albert C. Bean, Sr. Foundation; Ernest T. Trigg Scholarship and Joseph A. Vasta Memorials (vested through CIEF); Urban Polymers and Coatings; Valspar Foundation; Wicks Fund; Rheineck Memorial; and the Lowell F. Wood Fellowship for providing this opportunity in helping our students become involved in coatings science. Over the past 20 years (thanks to all scholarship contributors, alumni, and friends), over 600 scholarships have been awarded.

Continuing education is also offered by the Polymers and Coatings Department at NDSU. Two short courses are scheduled: the Coatings Science Course will be held June 1-12, 1998 on the NDSU campus in Fargo, ND; and after a successful offering of the Environmentally Compliant Coatings Course over the last two years, another course at Hilton Head, SC, was offered on January 20-23, 1998. Further information concerning the course content can be obtained by contacting our office, Tel: (701) 231-7633; Fax: (701) 231-8439, or E-mail: nupoly@plains.nodak.edu.

All Polymer and Coatings faculty are extensively involved in coatings research. Dr. Bierwagen continues his duties as Managing Editor of the *Progress in Organic Coatings* journal. During this past year, he has edited a book entitled *Corrosion Control by Organic Coatings*, to be published as an ACS Symposium Series book. Along with Profs. Dennis Tallman (Chemistry), Dave Farden (Electrical Eng), and

Marek Urban (Polymers and Coatings), Dr. Bierwagen contracted studies of aircraft coating durability in simulated exterior and corrosive environments for the U.S. Air Force. This year, Dr. Bierwagen presented papers at the 97th Meeting of the National Association of Corrosion Engineers (NACE); the Annual Meeting of the American Institute of Conservation of Art and Historic Objects (AIC); the Minneapolis Chapter of the Electrochemistry Society; the 13th International Corrosion Congress in Melbourne, Australia: University of Wollongong/Australia; BHP Research Labs/Australia. He also chaired a session on Corrosion at the 1997 Gordon Research Conference.

Dr. Glass continues research on water-soluble polymers for coatings. He edited six books and is also involved in organizing workshops in this area. He chaired a symposium on water-soluble polymers during last year's fall National American Chemical Society meeting. His research program involves the studies of associative thickeners with pigments, but much of his activity during the past year has focused on the use of water-soluble polymers in cosmetics and medical technologies. His water-soluble polymers consortium, which is a part of the NSF Coatings Research Center, receives a lot of industrial attention.

Dr. Soucek is presently involved in research focusing on four principle areas: development of chromate-free corrosion resistant primers for aluminum and steel substrates; waterborne topcoats for automobiles and aircraft; UV-coatings for wood, metal, and fiber optics; and development of better abrasion and chip resistant tests for coatings. Current research projects within Dr. Soucek's group typically span from model compound studies to the synthesis of new polymeric binders, and also to structure-property relationships of resultant coatings.

Dr. Urban continues his responsibility as Department Chairman and as Editor-in-Chief of the *Polymer Surfaces and Interfaces Book Series*. He has written two and edited six books, the most recent book is entitled *ATR Spectroscopy of Polymers–Theory and Practice*, published in 1996/97 by ACS. As part of the NSF Coatings Research Center, he established the Polymer and Coatings Vibrational Spectroscopy Consortium, with the focus on molecular level understanding of surface and interfacial analysis of coatings and films. The consortium is equipped with state-of-the-art spectroscopic and microscopic equipment. This year he will complete another book entitled *Laboratory Handbook of Organic* Coatings. Other endeavors involve activities as co-Director of the NSF U/I CRC. In 1997 Dr. Urban was an invited speaker at the North American Research Conference on Organic Coatings; American Chemical Society Meeting Philips Award Symposium; and presented a plenary lecture at the Gordon Research Conference on Coatings and Thin Films. His current activities involve research on non-destructive molecular analysis of coatings using step-scan photoacoustic FT-IR spectroscopy.

Further information about current activities and the NDSU P&C Program which is a site for the NSF Research Center in Coatings can be obtained from Prof. Marek W. Urban, Chairman, Department of Polymers and Coatings, North Dakota State University, Fargo, ND 58105. Please feel free to contact us: Tel: (701) 231-7633; Fax: (701) 231-8439; or E-mail: nupoly@plains.nodak.edu.; or http://www.ndsu.nodak.edu).

The University of Southern Mississippi Educates Students in Theory and Practice of Polymer Science

The principal function of a university is to educate by creating an atmosphere which stimulates and supports the growth and communication of ideas. Scientific research departments should ideally have the dual mission of: sharpening the thinking processes, the practical skills and the creativity of students, and training scientists to meet the technological needs of a modern industrial society.

In the Polymer Science Research Center at The University of Southern Mississippi, these ideals are taken seriously. The goal of the undergraduate program is to educate incoming students in the theory and practice of polymer science. As a student in our program, you will be introduced to the fundamentals and practical operating principles of polymer science and you will learn how to approach and execute a research program to further understanding. In the process, you will receive valuable training for a future career in academia, commerce or industry, particularly in industries which manufacture, process and use polymeric materials.

The Department of Polymer Science is housed in an 86,000 square feet, three-story building on the campus at The University of Southern Mississippi, in Hattiesburg, MS. The $19.7 million center was built and equipped with funds appropriated by Congress through the U.S. Department of Agriculture. The completion of the Polymer Science Research Center in 1991 marked the culmination of a long tradition of excellence in polymer science at this site, which commenced with the establishment of the Pan American Tung Research Institute on the campus in 1964, and continued with the founding of the Polymer Science Department in 1972.

The Polymer Science Department continues to change and grow. According to the 1993 ACS survey of federal funding for R&D reported in C&E News, USM's program is the fastest growing program in the nation. A 1997 survey by *U.S. News & World Report* of America's Best Graduate Schools, ranked USM's Polymer Science Program third in the nation and equal to that of the California Institute of Technology. More than half of the faculty have joined us in the last ten years adding to our strengths in areas of special significance for the future – hydrophilic polymers, colloid and surface science, ion-containing polymers, composites, polymer compatibility, and photophysics to mention a few.

Students in the Department of Polymer Science have access to many industrial-sponsored scholarships. Additional financial aid is available through the University. Polymer Science graduates are heavily recruited by industry and leading graduate schools, which in turn, offer many financial and intellectual opportunities.

For additional information, contact The University of Southern Mississippi, Graduate Recruiting Coordinator, Box 10076, Hattiesburg, MS 39406-0076; Tel: (601) 266-4868; Fax: (601) 266-5504; e-mail: polysci@www.psrc.usm.edu or http://www.psrc.usm.edu.

University of Missouri-Rolla Coatings Institute Offers Undergraduate and Graduate Programs

The undergraduate B.S. Degree in Chemistry with specialization in polymers and coatings is accredited by the American Chemical Society as one of the few accredited programs in polymer science in the United States. The faculty for the Polymers and Coatings Science program include:

Dr. Frank Blum, Professor of Chemistry—Polymer-solvent/polymer-surface interactions, polymer characterization, colloid chemistry, micro emulsions, liquid crystals, micelles and viscelse, NMR spectroscopy and diffusion.

Dr. Harvest Collier, Professor of Chemistry—Synthesis and characterization of inorganic and heterocycle-containing polymers, investigation of thermal and conductive properties of inorganic and polymer systems, preparation and characterization of metallomacrocycles, kinetics and mechanism of macro cycle reactivity.

Dr. Nicholas Leventis, Assistant Professor of Chemistry—Synthesis and characterization of redox complementary electrocromic polymers, chemical sensor devices based on conducting polymers, micro electrochemical devices.

Dr. James Stoffer, Professor of Chemistry and Director, Graduate Center for Materials Research—Polymers and coatings science, polymerization process, organic and polymerization mechanisms, the science of paints and coatings, transparent coatings.

Dr. Michael R. Van De Mark, Associate Professor of Chemistry and Director of the UMR Coatings Institute—Polymer synthesis and characterization, polymer/solvent interaction, ionomeric gels, modified electrodes via polymer adsorption, corrosion inhibition through ligating polymers, organic oxidative electrochemistry, coatings formulation.

Academic Education

The undergraduate program continues to strengthen. We now require our students who major in Coatings and Polymer Science within the Chemistry Department to write a senior thesis in publication format. This approach strengthens the student's ability to complete a project, organize information, and technically write in a concise and formal way. We have seen a significant improvement in our students' written communication skills due to this requirement. Many major corporations have indicated that written communication skill is a major problem nationally. The UMR campus has addressed this problem through comprehensive incorporation of this goal into the curricula.

The graduate program in Chemistry continues to grow with the enrollment being over 60, of which approximately half are doing coatings and polymer science research. The second largest group in chemistry are those involved in environmental and analysis. The need for organic and inorganic analytically trained environmental chemists is and will be strong well into the next century.

Research

A few of the coatings project titles from UMR include: water reducible acrylic polymer dynamics in the reduced state, flash rust inhibition—a mechanistic study, synthesis and characterization of new phthalocyanines, thermal release coatings technology, synthesis of poly (spiromacrocycles), recycled glass for coatings application, optical brightener-glass for coatings applications, anti corrosion-glass for coatings application, inorganic polymer encapsulation of reactive coatings, water-based camouflage coatings, synthesis and characterization of semiconductive polymers, spectroscopic characterization of biodegradeable composites, development of metal ion binding epoxy polymers, preparation and evaluation of high temperature wire coatings for transformers and motors (OPTEC Corp.), the use of ultrasonics for the dispersion of pigment for inks (K.C. Coatings), sol-gel processes for use as a coating, waterborne chlorinated polyolefins as adhesion promoters for plastic (Eastman), ultrasonically initiated free radical catalyzed polymerizations, microwave polymerizations, transparent composites, non chromated corrosion inhibitors for aluminum.

UMR is involved in research projects for numerous corporations both large and small as well as the Air Force, NASA, the Navy and many other federal agencies. If you have research needs with which we can assist, please feel free to contact us. We are always looking for projects for the students to work on, since research projects are a part of the undergraduate as well as the graduate program. Please contact us if you are interested in having a project at UMR.

For information about the Coatings Program at UMR, contact Dr. Michael R. Van De Mark, Director of UMR Coatings Institute or Dr. Harvest Collier or Dr. James O. Stoffer, University of Missouri–Rolla, Chemistry Dept., 142 Schrenk Hall, 1870 Miner Circle, Rolla, MO 65409-0010; (573) 341-4419; e-mail: coatings@umr.edu, or Web site: http://www.umr.edu/~coatings.

Philadelphia Society for Coatings Technology presents

Eastern Training Conference and Show

Training Conference: May 11-14, 1998
Show: May 12-13, 1998

Valley Forge Convention Plaza
King of Prussia, PA

Purpose and Overview

An introductory course aimed at an increased understanding of coatings for both technical and nontechnical personnel. The course will cover the essentials of coatings technology, and chart the course the industry is taking in its accelerated evolution towards an exact science. Attendees will learn the language of the industry and further their understanding of how raw materials function in both architectural and industrial finishes. Topics will range from simple calculations and basic formulations all the way to the driving forces that influence coating compositions.

Who Should Attend?

Anyone in the industry who wishes to gain a comprehensive understanding of its products and trends. Not only will lab technicians and formulators find it useful, but purchasing agents, sales, production, and manufacturing personnel will also benefit. The informal style of presentation encourages full class participation. No chemistry background is required but is always helpful. Attendees will benefit from the opportunity to network with others in the industry with whom they can share problems and solutions in class and for years to come.

Registration

Registration fee for the Eastern Training Conference and Show is $275.00 per person.

$ 275.00 X_____ Total Enclosed = _____
Registrations

Registration is limited to 150 on a first come, first served basis.

Registration fee includes luncheons. Complimentary materials consist of a compilation of notes on the subject matter presented.

The Show will take place in a nearby hall with tabletop displays. Over 100 supplier companies to the coatings manufacturing industry will be present to discuss their newest products and services. A wide variety of raw materials, production equipment, containers, filling equipment, laboratory apparatus, and testing devices for the paint and coatings producer will be displayed.

Registration Application

Please Print

Name_____

Company_____

Address_____

City_____ State _____ ZipCode_____

Phone Number _____ Fax:_____

Make Checks Payable to: **Eastern Training Conference and Show**

Mail registration and check to: Mr. Sam Firestone, S.E. Firestone Associates, 101 Surrey Rd., Melrose Park, PA 19027-2931.

For additional information, contact: Wayne A. Kraus, Hercules Incorporated, (302) 995-3435.
For registration and exhibit rental information, contact: Sam Firestone, S.E. Firestone Associates, (215) 635-1366.

1998 JCT Educational Guide to Coatings Courses, Symposia, and Seminars

This compilation of courses, symposia, and seminars on coatings-related topics is based on information obtained from Constituent Societies of the Federation, educators, and various industry sources.

ALASKA

NACE International
(National Association of Corrosion Engineers)

Basic Corrosion—April 12-17, 1998, Anchorage, AK

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

ARIZONA

Society for Imaging Science and Technology and the Society for Information Display

The Fifth Color Imaging Conference: Color Science, Systems, and Applications—November 17-20, 1998, Radisson Resort, Scottsdale, AZ

Contact: Society for Imaging Science and Technology, 7003 Kilworth Lane, Springfield, VA 22151.

CALIFORNIA

California Polytechnic State University
Department of Chemistry and Biochemistry

Concentration in Polymer and Coatings Chemistry: Chem 444 Polymers and Coatings I; Chem 445 Polymers and Coatings II; Chem 446 Surface Chemistry of Materials; Chem 447 Polymers and Coatings Lab I; Chem 448 Polymers and Coatings Lab II; Chem 449 Internship in Polymers and Coatings; Mate 206 Materials Engineering—California Polytechnic State University, San Luis Obispo, CA. Duration is one year for full program. Individual courses offered fall, winter and spring quarters.

The purpose of the program is to provide Chemistry and Materials Engineering majors with the skills and background necessary to enter the polymers and coatings industry with a proper background, and to prepare students for graduate study in polymers, coatings, or related fields. The program meets the American Chemical Society requirements for certification as a chemistry/polymers degree. Students must be admitted to undergraduate or graduate degree program at Cal Poly. Current in-state tuition is approximately $740 per quarter.

Contact: Dr. Dane Jones, Department of Chemistry and Biochemistry, California Polytechnic State University, San Luis Obispo, CA 93407; (805) 756-2528; Fax: (805) 756-5500; WWW: http://www.calpoly.edu/~chem/pandc.html.

Introductory Short Course in Basic Polymer and Coatings Chemistry—June 22-26, 1998

The purpose of this one-week course is to provide a basic working knowledge of polymer chemistry including methods of preparation, testing, and fabrication of polymeric materials. Specific examples related to modern coatings will be emphasized. Participants will formulate a modern paint using the polymers they synthesized, and will be instructed in the use of modern physical and chemical methods to test coatings. The course is designed for persons with some chemistry background or persons with some work experience in the coatings industry. Cost: $800 (includes all materials for the course, including lab fees, textbooks, meals and lodging in on-campus dormitories. Information on off-campus housing is available).

Contact: Dr. James Westover, Department of Chemistry and Biochemistry, California Polytechnic State University, San Luis Obispo, CA 93407; (805) 756-2566; Fax: (805) 756-1670; WWW: http://www.calpoly.edu/~chem/pandc.html.

California State Polytechnic University, Pomona and Los Angeles Society for Coatings Technology

Paint Formulation and Testing, Lab and Lecture— April-June 1998

This course will be taught on a college chemistry level and will teach ASTM techniques of paint testing, as well as dispersion theory and color matching. It will be offered on Tuesday evenings from 4:00 pm to 9:00 pm. This course is a result of a partnership between the LASCT and Cal Poly Pomona.

Contact: V. C. Bud Jenkins, Lecturer, 3366 Somis Dr., Riverside, CA 92507; (909) 682-4023.

Los Angeles Society for Coatings Technology

Basic Paint Technology—January-March 1998 (Second Quarter); April-June 1998 (Third Quarter)

Second quarter of Basic Paint Technology, taught by Frank Peters, Dunn-Edwards Corp., leads to Certificate by the LASCT in Basic Paint Technology. Held Thursday nights. The third quarter of Basic Paint Technology emphasizes corrosion chemistry control through coatings, and industrial maintenance coatings. This class also leads to a Certificate in Basic Paint Technology by the LASCT. Also held Thursday nights.

Contact: Frank Peters, Dunn-Edwards Corp., 4885 E. 52nd Pl., Los Angeles, CA 90040; (213) 771-3330.

NACE International (National Association of Corrosion Engineers)

Successful Coating & Lining of Concrete—May 29-30, 1998, San Diego, CA

This seminar will provide participants with an understanding of the methods and processes required to successfully select and apply coatings and linings to concrete surfaces. Topics addressed include an overview of the properties and weaknesses of concrete; methods for repairing defects; proper surface preparation steps; coatings for concrete; inspection, testing and related standards; specifications; and coating failures. The seminar is presented using state-of-the-art, multi-media techniques and includes lecture, discussion, and group exercises. Advance Fees: NACE Member $525, nonmember $650; Standard Fees: NACE member $625, nonmember $750.

Coatings Inspection Training & Certification-Session I—May 31-June 5, 1998, San Diego, CA

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Marine Coatings Inspection—June 1-3, 1998, San Diego, CA

This three-day marine coating inspection training program will cover the fundamental issues that are specific to coatings in worldwide marine environments. Types of coatings that are effective, surface preparation, application and inspection techniques, international regulations and standards and environmental issues will be discussed. This course has been developed by a broad spectrum of industry experts (including representatives from international marine coating companies, shipyard personnel and ship owners and operators), bringing proven strategies and know-how to the course content. Fees: NACE member $775; nonmember $895.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

Society for Manufacturing Engineers (SME)

Composites '98 Manufacturing and Tooling Conference and Exhibits—February 9-12, 1998, Hyatt Alicante, Anaheim, CA

Contact: SME, One SME Drive, P.O. Box 930, Dearborn, MI 48121-0930; (313) 271-1500.

DELAWARE

International Society of Coating Science and Technology (ISCST)

9th International Coating Science and Technology Symposium—May 17-20, 1998, John M. Clayton Conference Center, University of Delaware, Newark, DE

This symposium covers the area of liquid film coating and related process fundamentals and applications and provides a forum for discussion of recent advances in understanding the process of deposition and solidification of thin liquid films and its applications. Cost: $300; $350 after May 3.

Coating and Drying Process Technology Short Course—May 16-17, 1998, John M. Clayton Conference Center, University of Delaware, Newark, DE

This course covers the technology of coating continuous webs from fluid preparation to the drying of the coated web. Topics include an overview of the coating industry, fluid preparation and handling, roll coating, premetered coating, static electricity, and electrostatic assist, coating die design, web handling and drives, and dryers and drying. Cost: $995.

Fundamental Engineering Concerns in Film Coating Process—May 16, 1998, John M. Clayton Conference Center, University of Delaware, Newark, DE

This course covers three key aspects of film coating process: substrates properties that affect coating and coating product performances, substrate flatness, and film heat transfer. Cost: $695.

Introduction to Statistic Process Control for Coated Products—May 17, 1998, John M. Clayton Conference Center, University of Delaware, Newark, DE

The course objective is to compare traditional Statistical Process Control (SPC) with the techniques and concepts needed to successfully apply SPC concepts to coated products. Cost: $695.

Fundamentals of Web Handling for Coating Processes—May 17, 1998, John M. Clayton Conference Center, University of Delaware, Newark, DE

This course will cover web properties important to web handling, tension and traction control, web tracking and guiding, roller and nip considerations, wrinkling and winding. Cost: $695.

Contact: Gordon J. Amundson, University College, University of Minnesota, 207 Nolte Center, 315 Pillsbury Dr. SE,

Minneapolis, MN 55455-0139; (612) 625-3504; Fax: (612) 626-1632.

FLORIDA

The Electrocoat Association and Products Finishing

Electrocoat '98 Conference—March 25-27, 1998, Clarion Plaza Hotel, Orlando, FL

Objective is to provide a solutions-oriented conference agenda featuring sessions designed for those interested in, or starting out in, the electrocoat business, sessions addressing E-coat technology, process improvements, applications, industry trends, cost savings with E-coat, environmental advantages and more.

Contact: Cindy J. Goodridge, Executive Director, 6915 Valley Ave., Cincinnati, OH 45244; (513) 527-8977; Fax: (513) 527-8950.

Federation of Societies for Coatings Technology (FSCT)

ICE Latinoamerica '98—April 15-17, 1998, Miami Beach Convention Center, Miami, FL

A trade show for the South and Central American Coatings Industry. The show will also include a two-day conference on environmental and regulatory issues. Being held in conjunction with the successful "Plasticos de las Americas," a show directed to the Latin American plastics manufacturing industry, ICE Latinoamerica '98 will also provide a unique opportunity to those supplier companies serving both the coatings and plastics industries in the southern hemisphere.

Contact: Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422; (610) 940-0777; Fax: (610) 940-0292; http://www.coatingstech.org.

Institute of Materials Science at New Paltz

Adhesion and Coatings Adhesion: Theory, Practice & Durability—May 4-6, 1998, Orlando, FL

This intensive three-day short course provides a strong fundamental understanding of block and graft copolymer blends for those that are new to the field, and develops fully an understanding of the practical applications of the science for those already working in the field that are looking for specific solutions to job-related assignments. This course will cover the areas of basic polymer miscibility, miscibility theory pertaining to blocks and graft copolymers phase behavior of mixtures containing blocks and graft copolymers; morphology, mechanical properties, rheology, surface properties and synthesis of block and graft copolymers and mixtures of kratons. Cost: Advanced Fee - $995; After April 6 - $1,150.

Contact: Angelos V. Patsis, Director, Institute of Materials Science, State University of New York at New Paltz, New Paltz, NY 12561; (914) 255-0757; Fax: (914) 255-0978.

NACE International (National Association of Corrosion Engineers)

Successful Coating & Lining of Concrete—May 1-2, 1998, Orlando, FL

This seminar will provide participants with an understanding of the methods and processes required to successfully select and apply coatings and linings to concrete surfaces. Topics addressed include an overview of the properties and weaknesses of concrete; methods for repairing defects; proper surface preparation steps; coatings for concrete; inspection, testing and related standards; specifications; and coating failures. The seminar is presented using state-of-the-art, multi-media techniques and includes lecture, discussion, and group exercises. Advance Fees: NACE Member $525, nonmember $650; Standard Fees: NACE member $625, nonmember $750.

Basic Corrosion—February 1-5, 1998, Miami, FL and May 3-8, 1998, Orlando, FL

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Basic Protective Coatings & Linings—May 3-8, 1998, Orlando, FL

This course provides training on the fundamentals of protective coatings and linings, the application of basic coating systems, general information on the use of coatings systems, and why they are used for corrosion control. This course gives attendees a thorough understanding of the what, when, how, and where of protective coatings. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Coatings Inspection Training & Certification-Session I—May 3-8, 1998, Orlando, FL

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Coatings Inspection Training & Certification-Session II—May 3-8, 1998, Orlando, FL

Training Session II focuses on shop coating processes for steel, advanced inspection techniques, and introduces more sophisticated nondestructive and destructive tests and test instruments than those covered in Session I. Advance Fees (North America): NACE members $875;

nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Coatings Inspection Training & Certification-Session III—May 3-7, 1998, Orlando, FL

Training Session III covers specialized application methods and substrates other than steel. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Peer Review—May 8-9, 1998, Orlando, FL

Peer Review is an intensive, detailed oral examination of the candidate for recognition. The Peer Review lasts approximately two hours and covers practical and theoretical knowledge. Work experience verification documentation is required. Upon successful completion of Sessions I, II, and III, and the Peer Review, the participant will have attained Certified NACE Coating Inspector recognition. Advance Fees (North America): NACE members $625; nonmembers $750; Standard Fees (North America) NACE members $725; nonmembers $850; Outside North America: NACE members $1,075; nonmembers $1,200.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

Paint Research Association

Silicones in Coatings II—March 24-26, 1998, Orlando, FL

Contact: Dip Dasgupta, Paint Research Association, 8 Waldegrave Road, Teddington, Middlesex TW11 8LD United Kingdom.

The Society for Protective Coatings (SSPC)

Fundamentals of Protective Coatings (C-1)—March 9-13, 1998, Tampa, FL

This five-day course provides a practical overview of the issues and concerns affecting coatings operations with the latest information on corrosion, surface preparation and coatings application, quality control, and the total protective coatings program. Cost: $775 member; $860 nonmember.

Specifying and Managing Protective Coatings Projects (C-2)—March 9-13, 1998, Tampa, FL

This five-day course on how to become efficient and cost-effective when specifying and managing coatings projects covers standards and specification development, management of maintenance painting, working with the contractor, coating failure, and maintaining safety on the job. Cost: $775 member; $860 nonmember.

SSPC 98—November 15-19, 1998, Orange County Convention Center, Orlando, FL

International Conference and Exhibition with training courses, tutorials, and seminar presentations.

The following will be held in conjunction with SSPC 98. Specific course dates to be announced.

Fundamentals of Protective Coatings (C-1)

This five-day course provides a practical overview of the issues and concerns affecting coatings operations with the latest information on corrosion, surface preparation and coatings application, quality control, and the total protective coatings program. Cost: $775 member; $860 nonmember.

Specifying and Managing Protective Coatings Projects (C-2)

This five-day course on how to become efficient and cost-effective when specifying and managing coatings projects covers standards and specification development, management of maintenance painting, working with the contractor, coating failure, and maintaining safety on the job. Cost: $775 member; $860 nonmember.

Supervisor/Competent Person Training for Deleading of Industrial Structures (C-3)

This is a four-day course. Comprehensive round-ups on lead abatement basics such as regulations, safety and health hazards, and legal insurance issues are balanced with hands-on workshops in which you actually practice typical duties encountered on the job. Cost: $775 member; $860 nonmember.

Supervisor/Competent Person Refresher Training for Deleading of Industrial Structures (C-5)

This one-day course provides refresher training for supervisor/competent persons responsible for the deleading of industrial structures. The course meets the requirements of those state programs which require refresher training to maintain supervisor certification. Cost: $225 member; $260 nonmember.

Contact: Philip Cynar, SSPC, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656; (412) 281-2331 ext. 121; Fax: (412) 281-9993; E-Mail: cynar@sspc.org.

GEORGIA

American Society for Testing and Materials (ASTM)

Effects of Surface Finish on Corrosion Testing—May 5-6, 1998, Atlanta, GA

Contact: Pierre R. Roberge, Royal Military College of Canada, Dept. of Chemistry and Chemical Engineering, Kingston, ON K7K 5L0 Canada.

Paint & Decorating Retailers Association (PDRA)

Certified Paint Consultant—March 11, 1998, Atlanta, GA

This course will show you how to guide customers to the proper type of architectural coatings for their particular project, provide instructions on surface preparation and coatings application, ensure customers have all the tools and sundries needed for DIY projects, demonstrate the value of using quality products, recognize and resolve common coatings problems, advise customers on color and how to decorate with coatings, and sell more paint. Cost: $129 PDRA members; $189 nonmembers.

Contact: Margi Barnes, PDRA, 403 Axminister Dr., Fenton, MO 63026; (800) 737-0107; Fax: (314) 326-1823.

HAWAII

NACE INTERNATIONAL
(NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

Basic Protective Coatings & Linings— October 18-23, 1998, Pearl Harbor, HI

This course provides training on the fundamentals of protective coatings and linings, the application of basic coating systems, general information on the use of coatings systems, and why they are used for corrosion control. This course gives attendees a thorough understanding of the what, when, how, and where of protective coatings.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

ILLINOIS

DEPAUL UNIVERSITY

Master of Science in Coatings Technology—Chemistry Department, DePaul University, 1036 West Belden Ave., Chicago, IL

The mission of the program is to provide students with the skills necessary for work in research and development in the coatings field. The course of study involves most branches of chemistry including organic, polymer, physical, inorganic and analytical chemistry. Courses: a minimum of 44 quarter hours. Cost: $290 per hour.

Contact: Dr. Gregory B. Kharas, DePaul University, Chemistry Dept., 1036 W. Belden Ave., Chicago, IL 60614-3214; (773) 325-7367; Fax: (773) 325-7421.

RADTECH INTERNATIONAL NORTH AMERICA

RadTech '98 International UV/EB Processing Conference and Exhibition—April 19-22, 1998, Hyatt Regency, Chicago, IL

Program consists of technical presentations, applications sessions, poster papers, new product debut session and exhibits.

Contact: Chris Dionne, RadTech Intl., 60 Revere Dr., Ste. 500, Northbrook, IL 60062; (847) 480-9576; Fax: (847) 480-9282.

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

Fundamentals of Protective Coatings (C-1)—April 20-24, 1998, Chicago, IL

This five-day course provides a practical overview of the issues and concerns affecting coatings operations with the latest information on corrosion, surface preparation and coatings application, quality control, and the total protective coatings program. Cost: $775 member; $860 nonmember.

Specifying and Managing Protective Coatings Projects (C-2)—April 20-24, 1998, Chicago, IL

This five-day course on how to become efficient and cost-effective when specifying and managing coatings projects covers standards and specification development, management of maintenance painting, working with the contractor, coating failure, and maintaining safety on the job. Cost: $775 member; $860 nonmember.

Contact: Philip Cynar, SSPC, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656; (412) 281-2331 ext. 121; Fax: (412) 281-9993; E-Mail: cynar@sspc.org.

INDIANA

THE POWDER COATINGS INSTITUTE

Powder Coating '98 Conference and Trade Show—September 22-24, 1998, Indiana Convention Center, Indianapolis, IN

A three-day series of technical presentations and seminars to educate people about the powder coating application process.

Contact: Anne Goyer, Goyer Management, P.O. Box 54464, Cincinnati, OH 45254; (513) 624-9988; Fax: (513) 624-0601.

KENTUCKY

LOUISVILLE SOCIETY FOR COATINGS TECHNOLOGY

Spectrum of Coatings Science 1998—April 15, 1998, Executive West Motor Hotel, Louisville, KY

This one-day symposium will have multiple speakers on the following subjects with emphasis on R&D and product development: pigments, solvents, rheology, additives, instruments, and manufacturing. Cost: $60 (lunch included).

Contact: Ilona Duvall, Red Spot Paint & Varnish, 1107 E. Louisiana St., Evansville, IN 47711; (812) 467-2337; Fax: (812) 467-2339.

LOUISIANA

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY (FSCT)

ICE '98—FSCT Annual Meeting and International Coatings Expo and Technology Conference—October 11-16, 1998, Ernest N. Morial Convention Center, New Orleans, LA. Conference–October 11-13, 1998; Exposition and Annual Meeting Technical Program–October 14-16, 1998

With over 75 years of providing educational and technical programs for the coatings industry, the FSCT will host ICE '98—the largest exposition of coatings raw materials, production and laboratory apparatus and equipment, and services. In conjunction with the Expo, the Federation will host its Annual Meeting program featuring technical presentations from leading coatings experts. The Technology Conference offers one- and two-day seminars which provide hands on training, as well as lecture type instruction, geared for all levels of the coatings industry.

Contact: Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422; (610) 940-0777; Fax: (610) 940-0292; http://www.coatingstech.org.

NACE International (National Association of Corrosion Engineers)

Successful Coating & Lining of Concrete—February 6-7, 1998, New Orleans, LA

This seminar will provide participants with an understanding of the methods and processes required to successfully select and apply coatings and linings to concrete surfaces. Topics addressed include an overview of the properties and weaknesses of concrete; methods for repairing defects; proper surface preparation steps; coatings for concrete; inspection, testing and related standards; specifications; and coating failures. The seminar is presented using state-of-the-art, multi-media techniques and includes lecture, discussion, and group exercises. Advance Fees: NACE Member $525, nonmember $650; Standard Fees: NACE member $625, nonmember $750.

Coatings Inspection Training & Certification-Session I—February 8-13, 1998, November 1-6, 1998, New Orleans, LA, and May 17-22, 1998, Baton Rouge, LA

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Coatings Inspection Training & Certification-Session II—February 8-13, 1998 and November 1-6, 1998, New Orleans, LA

Training Session II focuses on shop coating processes for steel, advanced inspection techniques, and introduces more sophisticated nondestructive and destructive tests and test instruments than those covered in Session I. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Coatings Inspection Training & Certification-Session III—February 8-12, 1998 and November 1-5, 1998, New Orleans, LA

Training Session III covers specialized application methods and substrates other than steel. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Peer Review—February 13-14, 1998 and November 6-7, 1998, New Orleans, LA

Peer Review is an intensive, detailed oral examination of the candidate for recognition. The Peer Review lasts approximately two hours and covers practical and theoretical knowledge. Work experience verification documentation is required. Upon successful completion of Sessions I, II, and III, and the Peer Review, the participant will have attained Certified NACE Coating Inspector recognition. Advance Fees (North America): NACE members $625; nonmembers $750; Standard Fees (North America) NACE members $725; nonmembers $850; Outside North America: NACE members $1,075; nonmembers $1,200.

Marine Coatings Inspection—February 9-11, 1998, New Orleans, LA

This three-day marine coating inspection training program will cover the fundamental issues that are specific to coatings in worldwide marine environments. Types of coatings that are effective, surface preparation, application and inspection techniques, international regulations and standards and environmental issues will be discussed. This course has been developed by a broad spectrum of industry experts (including representatives from international marine coating companies, shipyard personnel and ship owners and operators), bringing proven strategies and know-how to the course content. Fees: NACE member $775; nonmember $895.

Basic Corrosion—April 26-May 1, 1998, November 1-6, 1998, and November 8-13, 1998, New Orleans, LA

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906;(281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

The University of Southern Mississippi

The 25th Annual International Waterborne, High-Solids, and Powder Coatings Symposium—February 18-20, 1998, New Orleans, LA

The Symposium consists of papers written by outstanding industrial and academic scientists and cover a wide range of topics. Cost: $595.

Practical Emulsion Polymerization—February 14-15, 1998, Hyatt Regency Hotel, New Orleans, LA

This course focuses on the synthesis of emulsion polymers. Therefore, professionals who wish to understand, and be able to use emulsion polymerization for the design, synthesis, stabilization, characterization, and application of latex polymers should attend. Cost: $795.

The Physical Principles of Formulation Part II: The Physical Principles of Formulating With Surfactants—February 14-15, 1998, Hyatt Regency Hotel, New Orleans, LA

This course is designed to educate professionals on these physical principles which are essential for a true understanding of product formulation. The creation of new formulated products will in the future be grounded upon a thorough understanding of the molecular and colloid-scale interactions of the components. The Physical Principles of Formulation will be presented in a three-part series. Cost: $795.

Design of Experiments for Coating Scientists—February 14-15, 1998 Hyatt Regency Hotel, New Orleans, LA

This two-day course serves as an introduction to Design of Experiments (DOE). In this course attendees will learn how to: a) Use DOE screening tools to find which of many possible factors are important, b) Develop DOE models that quantify the effects of the important factors, c) Identify the factor interactions that are effecting the process or product, d) Interpret DOE results using response surface method & optimization methods, e) Understand how DOE techniques can be used to quickly solve everyday problems. Cost: $795.

Modern Coatings Technology—February 16-17, 1998 Hyatt Regency Hotel, New Orleans, LA

This course offers contemporary coatings design, formulation, and testing. It focuses on conversion from solvent to waterborne, high-solids, and powder coatings. Individuals responsible for coatings formulation, development, and research will find the course a valuable source of usable information. Lectures will delineate formulation/performance relationships and convey appropriate methods for technological development of superior yet cost-effective coatings. Cost: $795.

Water-Soluble/Waterborne Polymers—February 16-17, 1998, Hyatt Regency Hotel, New Orleans, LA

This two-day short course has been specifically tailored for industrial scientists with emphasis on: structural features of water-soluble polymers, laboratory and industrial production processes, kinetics of polymerizations in aqueous phases including micellar, emulsion, and dispersion, analytical methods for water-soluble and water-dispersible polymers, solution properties and rheological behavior, coatings, personal care, environmentally benign formulation, naturally-occurring polymers/biopolymers, targeted adsorption, adhesion, and protection. Cost: $795.

Reformulating To Waterborne Coatings—February 16-17, 1998 Hyatt Regency Hotel, New Orleans, LA

This two-day course has been designed to offer practical "how to" information for implementing a variety of waterborne coating processes. Resin design and paint formulation considerations during conversion from a conventional solventborne coating to a waterborne coating will be discussed for a number of popular coating types. The course is intended to be useful to all segments of the industry, including raw materials manufacturers, paint formulators, and end-users. Cost: $795.

Contact: Laura M. Fosselman, Waterborne Coordinator, The University of Southern Mississippi, Box 10063, Hattiesburg, MS 39406-0063; (601) 266-4868; FAX: (601) 266-5504; E-mail: polysci@www.psrc.usm.edu.

MARYLAND

BALTIMORE SOCIETY FOR COATINGS TECHNOLOGY

Paints and Coatings, Level II—March 25–May 20, 1998, Catonsville Community College, Catonsville, MD

This eight-week course will cover formulating latex paints and coatings; formulating solvent paints and coatings, principles of research and development; and testing paints and coatings. Cost: $205.

Contact: Bill Sutton, 80 E. Padonia Rd., Unit 103, Timonium, MD 21093; (410) 675-4800; Fax: (410) 675-0038.

MASSACHUSETTS

NACE INTERNATIONAL
(NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

Coatings Inspection Training & Certification-Session I—February 22-27, 1998, Boston, MA

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Marine Coatings Inspection—March 1-3, 1998, Boston, MA

This three-day marine coating inspection training program will cover the fundamental issues that are specific to coatings in worldwide marine environments. Types of coatings that are effective, surface preparation, application and inspection techniques, international regulations and standards and environmental issues will be discussed. This course has been developed by a broad spectrum of industry experts (including representatives from international marine coating companies, shipyard personnel and ship owners and operators), bringing proven strategies and know-how to the course content. Fees: NACE member $775; nonmember $895.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906;(281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

NEW ENGLAND SOCIETY FOR COATINGS TECHNOLOGY AND UNIVERSITY OF MASSACHUSETTS LOWELL

Individual courses and/or Master of Science in Plastics Engineering, Coatings and Adhesives Option—September-December & January-May, University of Massachusetts Lowell, Lowell, MA

Coatings Science and Technology I & II (26.533/4)

Polymers, pigments, solvents, and additives used in coatings. Methods of polymerization, formulation, application, and testing. Substrates and applications.

Introductory Polymer Science I & II (84.403/4)

Coverage of step and chain growth polymerizations, kinetics and mechanism, copolymerization, ionic and free radical polymerizations, and industrially important polymers. An introduction to the physical chemistry of polymers including molecular weight distribution and averages, polymer solutions, fractionation, methods of molecular determination, and structure.

Polymer Laboratory I & II (84.405/6)

An introductory laboratory in polymer science concerned with the physical and chemical characterization of polymers, and techniques of polymer synthesis.

Mechanical Behavior of Polymers (26.503)

Mechanical behavior of bulk polymers. Linear viscoelasticity, creep, relaxation, dynamic and stress/strain phenomena. Principles of time/temperature superposition. Rubber elasticity. Failure behavior of polymeric materials.

Rheology of Coatings (26.536)

Rheology of polymer melts, solutions, latexes, and pigment dispersions, and their application to coatings and adhesives.

Adhesives and Adhesion (26.532)

Adhesive joining of engineering materials. Surface chemistry, theories of adhesion and cohesion, joint design, surface preparation, commercial adhesives, rheology, equipment, testing, service life, and reliability.

Seminar (26.601/2)

Coatings literature searching, reporting, and discussion.

Masters Thesis Research (26.743/6)

Individual research projects in coatings and adhesives.

Contact: Rudolph D. Deanin, Graduate Coordinator, Plastics Engineering, University of Massachusetts Lowell, Lowell, MA 01854; (978) 934-3426; Fax: (978) 458-4141.

Paint & Decorating Retailers Association (PDRA)

Certified Paint Consultant—April 8, 1998, Boston, MA

This course will show you how to guide customers to the proper type of architectural coatings for their particular project, provide instructions on surface preparation and coatings application, ensure customers have all the tools and sundries needed for DIY projects, demonstrate the value of using quality products, recognize and resolve common coatings problems, advise customers on color and how to decorate with coatings, and sell more paint. Cost: $129 PDRA members; $189 nonmembers.

Contact: Margi Barnes, PDRA, 403 Axminister Dr., Fenton, MO 63026; (800) 737-0107; Fax: (314) 326-1823.

MICHIGAN

Detroit Society for Coatings Technology

FOCUS Conference—April 21, 1998, MSU Management Education Center, Troy, MI 48089

23rd Annual Conference, "Innovative Coatings: Practical Solutions for Global Demands" features two tracks of expert speakers on coatings technology. Presentations are geared to a technically oriented audience of chemists, engineers, and others with an interest in leading edge technologies for the coatings of the future. This year's Conference will also feature a separate tutorial short course, "Painting and Processing Plastics."

Contact: Rosemary Brady, Akzo Nobel Coatings, Inc.; (248) 637-8565.

Eastern Michigan University

Polymers & Coatings Technology I (INDT 400) (3 credit hours)—September–December, Eastern Michigan University, Ypsilanti, MI

A one semester introduction to synthesis, film formation, structure and properties of polymers commonly used in coatings. Polymers systems to be covered include acrylic, vinyls, polyesters, alkyds, oils, epoxies, epoxyesters, aminoplasts, urethanes, phenolics, hydrocarbons, cellulosics.

Polymers & Coatings Technology II (INDT 402) (3 credit hours)—January–April, Eastern Michigan University, Ypsilanti, MI

One semester course in formulation in oil-based and waterborne coatings covering the use of solvents, pigments and additives. Principles of adhesion and corrosion and use of conversion coatings. Safety, health, environment, government regulations and paint production techniques.

Advanced Coating Topics (INDT 460) (3 credit hours)—January–April, Eastern Michigan University, Ypsilanti, MI

One semester course in development of in-depth formulating skills, new technology areas in coatings and polymers.

Powder Coatings (INDT 479) (3 credit hours)—January–April, Eastern Michigan University, Ypsilanti, MI

The objective of this one semester course is to gain an overall understanding of powder resins: how they are made and formulated, both thermoplastic and thermoset, applications and various areas where they are used including automotive, general metals, plastics, etc., and learn new developments in powder coatings.

Polymers for Engineers and Technologists (INDT 310) (3 credit hours)—September–December, Eastern Michigan University, Ypsilanti, MI

This one semester course is an introduction to polymer science, polymerization, polymer modification, size and

weight of polymer molecules, glass transition temperatures, relaxation in polymers, structure-property relationships, and polymer fabrication techniques.

Water-based Coatings (INDT 379) (3 credit hours)—September–December, Eastern Michigan University, Ypsilanti, MI

A one semester course covering formulation of water-based coatings including polyester, oils, acrylics, epoxy resins, polyurethane resins, water-soluble polymers, emulsions and suspension polymerization.

Special Topics: Statistical Process Control in Coatings (INDT 479A)—September–December, Eastern Michigan University, Ypsilanti, MI

One semester course of topics dealing with quality issues, application of basic statistical tools, problem solving techniques and proper training of personnel.

Contact: James Woo, Eastern Michigan University, 201 Sill Hall, Ypsilanti, MI 48197; (313) 487-1235; Fax: (313) 487-8755.

Polymers and Coatings Technology Lab I (INDT 401)—Eastern Michigan University, Ypsilanti, MI

This laboratory course is intended to teach coating formulation, application and evaluations. In this course students prepare a variety of paint products ranging from architectural to automotive coatings.

Polymers and Coatings Technology Lab II (INDT 403)— Eastern Michigan University, Ypsilanti, MI

This course is the continuation of Polymers and Coatings Technology Lab 401. Students learn how to synthesize and characterize polymers, prepare advanced coating formulations. Application and evaluation of coatings are also included in this course.

Advanced Coatings Formulation (INDT 590)— Eastern Michigan University, Ypsilanti, MI

The purpose of this course is to familiarize students with advanced formulations and applications in automotive, waterborne, UV cure, powder coating and other relevant topics.

Topics in Coatings (INDT 591)— Eastern Michigan University, Ypsilanti, MI

Special topics including adhesion and corrosion phenomenon, rheology, dispersion, appearance and color science, coating plastics, coating defects characterization and prevention are discussed in this course.

Durability and Performance of Coatings (INDT 592)— Eastern Michigan University, Ypsilanti, MI

The objective of this course is to teach chemistry and physics and parameters influencing the durability and performance of polymers and coatings. Methods of enhancing durability and performance are also discussed.

Contact: Dr. Jamil Baghdachi, Eastern Michigan University, 201 Sill Hall, Ypsilanti, MI 48197; (313) 487-1235.

Paint & Coatings Industry Magazine

First International Coatings for Plastics Symposium—June 8-10, 1998, MSU Management Education Center, Troy, MI

Objective is to present leading edge coatings for plastics technology through invited expert speakers and exhibitions. Cost: $495 attendee; $595 exhibitor.

Contact: Harper Henderson, 755 W. Big Beaver Rd., Ste. 1000, Troy, MI 48084; (248) 244-6478; Fax: (248) 244-6439; email: harperh@bnp.com.

University of Detroit Mercy

Polymer Institute Symposia and Short Courses

New Trends in Polymer Developments, Recycling and Isocyanate-based Waterborne Coatings (annual one day symposium—September/October)

Basic Principles & Manufacturing Technology of Polyurethane Foams (five-day short course—tentatively scheduled for Fall 1998)

Training courses individualized to suit client's needs.

Department of Chemical Engineering and Polymer and Plastics Engineering Courses:

The following polymer-oriented courses will be offered Summer and Fall terms; they will be held in the evening.

Polymer Rheology (PPE 438)—Summer

Emphasizes flow phenomena or non-Newtonian materials. Steady and unsteady flow, confined and free flow, simple shear, and extensional flow are studied. Mathematical models of these flow phenomena are investigated for application to design and control.

Polymerization Engineering (PPE 440)—Summer

Techniques and equipment required for the polymerization of vinyl and divinyl monomers and formation of condensation polymers are studied. Bulk solution, emulsion, and dispersion techniques are compared. The effects of polymerization technique on processing characteristics are examined.

Science and Technology of Adhesion (PPE 474/574)—Fall

Provides a comprehensive view of adhesion from the basic theory to current applications. The main types of adhesives such as epoxies, polyurethanes, acrylics, and phenolics are studied. Applications to the construction, electrical, and automotive industries are covered.

Advanced Polymer Engineering Laboratory (CHE 463/563)—Winter (January)

A new course designed to provide an in-depth study of the common testing and characterization methods such as rheometry, FTIR, stress/strain measurements, and TGA. Lectures complement the laboratory experience, which will be based on common polymeric materials.

Department of Chemistry Courses

Polymer Engineering and Science I (CHM 420) (CHM 550-Graduate)—early September to mid-December

Provides an overview of terminology, synthesis, properties, and fabrication of polymers and the systematic coverage of major classes of macromolecules including their preparation, properties and uses.

Polymer Engineering and Science II (CHM 421) (CHM 551-Graduate)—early January to mid-May

Systematic coverage of major classes of macromolecules including their preparations, properties and uses.

Polymer Science Coating I (CHM 425) (CHM 525-Graduate)—early September to mid-December

Designed to relate the chemical, physical and mechanical properties of polymers with their functions as protective coatings. Comparisons are made between coatings made with various polymers such as acrylics, polyesters and polyurethanes, alkyds, and varnishes. The effects of solvent and mixtures of solvents, fillers, wetting and flatting agents are related to the special requirements of coatings. The equipment required for the preparation and applications of coatings is discussed, as well as the necessary evaluation tests and the significance of these tests.

Polymer Science Coating II (CHM 426) (CHM 525-Graduate)—early January to mid-May

A continuation of CHM 425 including the following: comparisons are made between coatings made with various polymers such as acrylics, polyesters and polyurethanes. The equipment required for the preparation and applications of these coatings is discussed, as well as the necessary evaluation tests and the significance of these tests.

CEUs are given for the following Continuing Education Courses:

Coating and Corrosion Prevention: Applications and Processes

Paint and coating properties, selection and application. Surface pretreatment methods. How to promote and maintain adhesion. Fundamentals of corrosion and corrosion prevention by coating. Surface defects, characterization and prevention. Coating evaluation and paint failure analysis.

Principles of Color Technology

Hands-on course for beginners. Learn principles of color matching. Students do their own spraying.

Painted Plastics/Interior & Exterior Automotive Approval Requirements.

Automotive requirements (specifications and testing). Automotive industry's supplier approval process. Automotive plastic and paint material selection criteria. OEM, molder, material supplier, and paint supplier interfaces for successful application.

Coatings Lab

Operation of instruments used in quality control and R&D in industrial, automotive and architectural labs. Conduct tests relating to paint manufacturing process and discover how these relate to field performance.

Adhesion and Durability of Polymeric Coatings

Requirements for a good adhesion. Methods of promoting and maintaining adhesion. Relationship between coating resins and adhesion. Effect of adhesion on performance of coatings. Selection of adhesion promoters for plastics and metals. Relationships between adhesion, corrosion resistance and durability of coatings.

Surface Coatings Technology

Principles of formulation. Pigment dispersions. Paint dryers and additives. Formation and structure of paint films.

Selection of Paints and Plastics in Automotive Applications

Plastic types/end use. Factors in selection of plastics. Reasons for coating plastic substrates. Adhesion of coatings to plastics. Plastic surface pretreatments.

Problem Solving in Coatings Using Analytical Techniques

Dissection and analysis of coating problems. Fundamental understanding of current analytical techniques. Selection of proper instruments and accessories. Problem solving in paint manufacturing. Analysis of paint defects.

Polymer Technology for Coatings

Overview of basic polymer concepts. Polymers for auto coatings emphasized. Paint calculations. Relationship between polymer structure and coatings properties.

Auto and Industrial Finish Processing

Cleaning and preparation. Coatings application: manual and automatic. Finish coating. Testing results.

Contact: Dr. Kurt C. Frisch or Mrs. Eleanore Eldred, Polymer Institute, University of Detroit Mercy, 4001W. McNichol Rd., P.O. Box 19900, Detroit, MI 48219; (313) 993-1270; Fax (313) 993-1409 or Dr. Geoffrey Prentice, Dept. of Chemical Engineering, University of Detroit Mercy, 4001 W. McNichol Rd., P.O. Box 19900, Detroit, MI 48219; (313) 993-3378; Fax (313) 993-1187.

MINNESOTA

NACE International
(National Association of Corrosion Engineers)

Basic Corrosion—November 8-13, 1998, Minneapolis, MN

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case

studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

MISSISSIPPI

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Introduction to Coatings Science—March 9-12, 1998, Shelby Freland Thames Polymer Science Research Center, The University of Southern Mississippi, Hattiesburg, MS

This is a four-day, all lecture short course that teaches the basic principles of synthesis, design, testing, and performance evaluation of solvent, waterborne, high-solids, UV cured, and powder coatings. Curing techniques and methods to lower VOCs are also highlighted. Cost: $950.

Practical Emulsion Polymerization Technology—March 9-12, 1998, Shelby Freland Thames Polymer Science Research Center, The University of Southern Mississippi, Hattiesburg, MS

This is a four-day short course that combines lectures with hands-on laboratory activities. The lectures emphasize synthesis and characterization of emulsion polymers and formulation for their use in coatings, adhesives, and inks. The lab sessions focus on the importance of equipment assembly, designing emulsion polymer recipes, polymer synthesis and characterization, and latex film property testing. Cost: $1,495.

Introduction to Powder Coatings Technology—May 11-14, 1998, Shelby Freland Thames Polymer Science Research Center, The University of Southern Mississippi, Hattiesburg, MS

This is a four-day short course with lectures and laboratory activities. Lectures emphasize powder coatings markets, chemistry of thermoplastic and thermosetting powders, advantages and limitations of powder coatings, equipment used in the formulation, application, and curing of powders, and trends and new developments in powder coatings. Lab sessions constitute approximately 40% of the course and include demonstration of equipment used in the manufacture, application, evaluation, and testing of powder coating performance. The lab sessions provide participants hands-on experience in processing, application, and evaluation of powder coatings as per ASTM and PCI standards. Cost: $950.

Coatings Science for Coatings Technicians, May 18-21, 1998, Shelby Freland Thames Polymer Science Research Center, The University of Southern Mississippi, Hattiesburg, MS

This is a four-day short course that combines lectures with laboratory activities. Lectures emphasize basic principles of coatings design, synthesis, testing, and performance evaluations of industrial and trade sales coatings. Lab sessions focus on the use of instrumentation, and techniques to identify, evaluate, and test coating performance. Lab sessions constitute approximately 45% of the course and offer participants hands-on experience in evaluating and testing performance of solvent, waterborne, and high-solids coatings. Cost: $950.

Coatings Science for Coatings Formulators—June 15-18, 1998, Shelby Freland Thames Polymer Science Research Center, The University of Southern Mississippi, Hattiesburg, MS

This is a four-day short course with lectures and laboratory activities. Lectures teach coatings composition, basic formulating principles especially additives, techniques and equipment for coatings manufacture, as well as performance testing of industrial and trade sales coatings. Formulating strategies and polymer design to reduce VOCs are highlighted. Coatings performance criteria of architectural, waterborne, and high-solids coatings are emphasized. Lab sessions are designed to provide instruction in additive formulation, equipment and techniques for manufacture, evaluation and testing coatings performance. Lab sessions constitute approximately 40% of the course and afford participants hands-on experience in manufacture, testing, and analyzing test data of architectural, waterborne, and high-solids coatings as per ASTM and industry standards. Cost: $950.

Coatings Science for Coatings Chemists—June 22-25, 1998, Shelby Freland Thames Polymer Science Research Center, The University of Southern Mississippi, Hattiesburg, MS

This is a four-day, all lecture in-depth short course. It emphasizes the theory and practical aspects of polymer synthesis and characterization, and the principles dictating coating selection, design, formulation, testing, and performance evaluation. Contemporary VOC lowering technologies to develop environmentally friendly coatings are highlighted and include waterborne, high solids, powder, and UV curable coatings. It incorporates the principles of polymer chemistry, strategies for selection of coating components, their use level, mechanism of action, and influence on coating properties. Cost: $950.

Contact: Dr. Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037; (601) 266-4080 or 5618; Fax: (601) 266-5880; E-mail: Shelby.F.Thames@usm.edu or dballard@whale.st.usm.edu.

MISSOURI

UNIVERSITY OF MISSOURI-ROLLA

Chemistry Curriculum (with Specialization in Polymer and Coatings Science)—This program encompasses the standard chemistry curriculum, plus courses in coatings, surface, and polymer chemistry. It is designed to provide undergraduate training in coatings science and technology.

Students seeking coatings science specialization are encouraged to seek summer employment at a coatings-oriented firm, as well as cooperative work-study programs with such firms. Students also participate in a senior research project in polymer and coatings science. This leads to the B.S. degree in Chemistry. M.S. and Ph.D. degree programs are also available for graduate studies.

Chemistry and Inherent Properties of Polymers (Chem 381)

A basic study of the organic chemistry of natural and synthetic high polymers, their inherent properties, and

their uses in plastic, fiber, rubber, resin, food, paper, and soap industries.

Polymer Science Laboratory (Chem 384)

Lectures and laboratory experiments dealing with polymerization reactions, solution properties, and bulk or solid properties will be presented. Each student will prepare polymers and carry out all characterization experiments on actual samples which were prepared.

Fundamentals of Protective Coatings I (Chem 385)

Study of the basic principles of protective coatings with particular reference to the paint and varnish industry. Classification, manufacture, properties, and uses of protective coatings.

Inorganic Polymers (Chem 401)

A study of non-traditional organic and inorganic polymers and polymerization processes. Survey and discussion of classes of inorganic polymers, their characterization and application.

Polymer Physical Chemistry and Analysis (Chem 484)

A study of the physical properties of macromolecular systems including polymer solutions, gels, bulk polymers and rubbers. The chemical characterization of polymers based on their thermal, spectroscopic, microstructure and molecular weight is also discussed.

Structure and Properties of Polymer (Chem E 375)

A study of the parameters affecting structure and properties of polymers. Syntheses, mechanisms, and kinetic factors are emphasized from the standpoint of structural properties.

Corrosion and Its Prevention (Chem E 381)

A study of the theories of corrosion and their application to corrosion and its prevention.

Chemical Engineering of High Polymers (Chem E 383)

Solution properties, molecular weight determination, and bulk properties including rheological behavior of high polymers are studied and used to explain techniques of characterization, manufacture, and procession of representative commercial types.

Chemical Engineering Fluid Dynamics (Chem E 439)

Fundamentals of Newtonian flow, non-Newtonian flow, flow through packed beds, two-phase flow, flow around submerged objects, and other related topics are discussed.

Plasma Polymerization (Chem E 475)

Fundamental aspects of polymer formation in plasma (weakly ionized gas), and properties of polymers formed by such a process will be studied.

Polymer Membranes for Separation (Chem E 476)

Basic principles of transport through a polymer membrane and transport characteristics of some polymers are studied. The selection of polymers and the method of preparing functional membranes for some separate processes are also studied.

Contact: Michael R. Van De Mark, Harvest Collier, or Jim Stoffer, Chemistry Department, University of Missouri-Rolla, Rolla, MO 65409-0010; (573) 341-4420.

UMR Coatings Institute

Basic Coatings for People in the General Industry, Sales & Marketing—February 23-25, 1998 and July 13-15, 1998, St. Louis, MO

Emphasis of this short course is on paint composition and is presented in common terms that the general industry can relate to. This course includes: composition of coatings, relationships between composition and performance characteristics and customer specifications and testing techniques as related to formulation criteria. Course notes are provided. Fee: $745.

The Basic Composition of Coatings—March 23-27, 1998 and September 14-18, 1998, UMR Campus, Rolla, MO

Offered twice a year, this short course is designed to introduce the newcomer, as well as those involved in raw material manufacture, sales and technical service, to the technical aspects of paint manufacture, testing and use. Topics of discussion include the history of paint, materials used in manufacture, simple formulating techniques that can be put to immediate use, introduction to the equipment used to make and test modern protective coatings, modern chemical instrumentation as applied to coatings, and simple cost accounting that allows beginners to start on a stable economic basis. There will be over four hours of demonstrations throughout the lecture period on topics such as paint milling, color development and many others. Course notes are provided for each attendee. Fee: $875.

Introduction to Paint Formulation—April 20-24, 1998, June 8-12, 1998, September 28-October 2, 1998, UMR Campus, Rolla, MO

This intensive five-day course will take you through the basic steps of paint formulation, from understanding the process to an actual laboratory formulation. Through study and work in a laboratory, you can learn to formulate paints to meet specific requirements. You will have the opportunity to study and experiment with basic raw materials and their influences on the performance of the finished coating, formulation and testing of coatings in the laboratory to meet the special demands of the job, limitations of plant production equipment and formulation variables for moving a coating from the lab to the plant and modern chemical instrumentation as applied to coatings. Fee: $975.

Physical Testing of Paints and Coatings—May 18-22, 1998, UMR Campus, Rolla, MO

This course is designed to improve quality control protocol for paints and coatings. This intensive course will show participants how to better measure the quality of paint and will explore instrumental methodology, i.e. rheology, chromatography, thermal analysis and spectroscopy as well as some others. All tests are based on ASTM methods and other currently acceptable prac-

tices. Course notes are provided for each attendee. Fee: $975.

Introduction to Coatings—November 2-4, 1998, St. Louis, MO

This short course is designed to give an end user or a new-comer without technical training an introduction to paint. This general descriptive course will give the participant a better understanding of the terms used and typical uses for various coatings. This course is not intended for people with a strong technical background. The course will include: basic knowledge of the composition of coatings, substrate and surface preparation, specifications and testing, and general manufacturing criteria. Course notes are provided for each attendee. Fee: $745.

Contact: Karen K. Markley, Coordinator, Department of Chemistry, 236 Schrenk Hall, 1870 Miner Circle, University of Missouri-Rolla, Rolla, MO 65409-0010; (573) 341-4419; Fax: (573) 341-4881; E-mail: coatingsumr.edu.

NEVADA

WESTERN COATINGS SOCIETIES

Western Coatings Societies' 24th Biennial Symposium and Show "Doorway to the Millennium"—February 15-17, 1999, John Ascuaga's Nugget Hotel Resort, Reno/Sparks, NV

This three-day event hosted by the Golden Gate Society, includes a full technical program, table top format paint show/exhibits and educational classes.

Contact: Harold R. Harlan, III, 11 Duboce Ave., San Francisco, CA 94103; (415) 621-7245; Fax: (415) 621-7622.

NEW JERSEY

THE CENTER FOR PROFESSIONAL ADVANCEMENT

Additives for Coatings—September or October 1998, New Brunswick, NJ

This three-day survey-type course will serve as an introduction to, and study of, additives which are basic to the development of paints, coatings, inks and plastics. The chemical make-up of additives, the way in which they function, their purpose and methods of incorporation will be covered. Cost: $1,035.

Powders: Their Properties and Processing—November 1998, New Brunswick, NJ

The primary purpose of this three- or four-day course is to review the various properties of powdered solids pertinent to the development and manufacture of the products of the pharmaceutical, cosmetic and allied industries. In particular, the latest experimental techniques and equipment for evaluating important properties of powders will be discussed and related to both the underlying principles and common industrial problems. Cost: $1,045/3 days; $1,305/4 days.

Pharmaceutical Coating Technology—October 1998, New Brunswick, NJ

The aim of this three-day course is to review the background technology, the practical techniques and the problems involved in modern tablet coating operations. Among the topics to be covered are traditional sugar-coating methods together with those currently being advocated for film coating, including a discussion of the potential for optimization of the coating process. Cost: $1,035.

Contact: Registrar, The Center for Professional Advancement, 144 Tices Lane, P.O. Box 1052, East Brunswick, NJ 08816; (732) 613-4500; Fax (732) 238-9113.

NEW YORK SOCIETY FOR COATINGS TECHNOLOGY AND METROPOLITAN NEW YORK PAINT AND COATINGS ASSOCIATION

Coatings Course, Part I-IV—January, April, & September (Winter, Spring, Fall), Fairleigh Dickinson University, Hackensack, NJ

This four semester course serves as a basic training program relating to paint and coatings chemistry. The first semester covers water-based tradesales, formulations, and applications. The second semester focuses on formulating know-how, applications, calculations, and terminology. Topics discussed during the third semester include industrial coating formulation and applications. The fourth semester covers rheology, dispersion theory and equipment, SPC and ISO certification.

Contact: George M. Schmitz, 3 Laurel Way, Sea Cliff, NY 11579; (516) 676-4654; Fax: (516) 656-4654; E-Mail: George.Schmitz@Reichhold.com.

NEW YORK

NACE INTERNATIONAL
(NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

Coatings Inspection Training & Certification-Session I—February 15-20, 1998, New York, NY

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

ROCHESTER INSTITUTE OF TECHNOLOGY,
MUNSELL COLOR SCIENCE LABORATORY

Colorimetry and Color Measurement—June 1-3, 1998, RIT Munsell Color Science Laboratory, Rochester, NY

This course will focus on the applications of colorimetry for industrial color control of materials. Key topics include spectrophotometry: principles, geometry selection,

and methods of characterizing precision and accuracy; CIE colorimetry: derivation of colorimetry from XYZ through CIELAB; and tolerancing: CMC and CIE94 equations, deriving visual tolerances from historical pass/fail data, and optimizing l:c ratios. Additional topics include: terminology, color vision, color order systems, illuminant and observer metamerism, and color TQM concepts. Cost: $800.

Instrumental Color Matching—June 4, 1998, RIT Munsell Color Science Laboratory, Rochester, NY

This course will present techniques to successfully use computer colorant formulation systems in an industrial environment. Topics include: colorant identification via spectral analyses; additive functions of reflectance (Kubelka-Munk) and transmittance (Beer-Lambert), semi-quantitative production batch adjustments, principles of computer colorant formulation, methods to get the most out of your system, and a problem solving session. Cost: $350.

Colorimetry for Imaging—June 8, 1998, RIT Munsell Color Science Laboratory, Rochester, NY

Topics in this intensive short course include an overview of color vision and appearance, photometry, colorimetry mathematics, color measurement instrumentation, color space transformations, and color quality metrics. Cost: $375.

Colorimetric Device Characterization—June 9-10, 1998, RIT Munsell Color Science Laboratory, Rochester, NY

Topics include scanner colorimetry using multiple-linear regression and spectral estimation techniques; CRT colorimetry using the CIE technique; binary printer colorimetry for cluster dot, FM screening, and conventional rotated screen halftoning devices; continuous tone printer colorimetry using Kubelka-Munk theory; and the basics of building device profiles. Cost: $750.

Color Appearance Models—June 11-12, 1998, RIT Munsell Color Science Laboratory, Rochester, NY

Color-appearance models extend basic colorimetry, as typified by CIE tristimulus values, to the prediction of color matches and color appearance across widely varying viewing conditions. Topics include important aspects of human vision, color appearance terminology, color-appearance phenomena, derivation of color appearance models (including Nayatani, Hunt, RLAB, LLAB, CIELAB and ATD), testing of color-appearance models, applications, and implementation. Cost: $750.

Contact: Colleen M. Desimone, RIT Munsell Color Science Laboratory, Chester F. Carlson Center for Imaging Science, 54 Lomb Memorial Drive, Rochester, NY 14623-5604; (716) 475-7189; Fax: (716) 475-5988; E-mail: CMD9553@rit.edu or http://www.cis.rit.edu/research/mcsl/courses.html.

The Society for Protective Coatings (SSPC)

Fundamentals of Protective Coatings (C-1)—April 27-May 1, 1998, Buffalo, NY

This five-day course provides a practical overview of the issues and concerns affecting coatings operations with the latest information on corrosion, surface preparation and coatings application, quality control, and the total protective coatings program. Cost: $775 member; $860 nonmember.

Specifying and Managing Protective Coatings Projects (C-2)—April 27-May 1, 1998, Buffalo, NY

This five-day course on how to become efficient and cost-effective when specifying and managing coatings projects covers standards and specification development, management of maintenance painting, working with the contractor, coating failure, and maintaining safety on the job. Cost: $775 member; $860 nonmember.

Contact: Philip Cynar, SSPC, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656; (412) 281-2331 ext. 121; Fax: (412) 281-9993; E-Mail: cynar@sspc.org.

NORTH DAKOTA

North Dakota State University

Intensive Coatings Science Course—June 1-12, 1998, North Dakota State University, Fargo, ND.

This two-week course is structured to present a comprehensive balanced view of the subjects. This is not a symposium. Lectures and discussions are scheduled from 8:00 am to Noon and from 1:15 pm to 4:45 pm. Faculty meet with participants for optional evening discussion sessions and are available for individual or small-group discussions at meal-time and during breaks. The atmosphere is informal, and our experience indicates that participants will find this format highly profitable. Coverage of the following topics are offered: chain-growth and step-growth polymerization resins; film formation; acrylic, polyester, alkyds; amine-formaldehyde resins; crosslinking; epoxy resins; urethane coatings; pigments and pigment dispersions; solvents; coatings formulation; rheology, appearance of coatings; powder coatings; high solids; radiation curing; corrosion; and structure-property relationships. Cost: $2700–2 week attendance; $1400–1 week attendance.

Contact: Dr. Marek W. Urban, Course Director, or Deborah Shasky, Program Coordinator, NDSU - Polymers & Coatings Dept., 54 Dunbar Hall, Fargo, ND 58105; (701) 231-7633; Fax (701) 231-8439; E-mail: nupoly@plains.nodak.edu.

OHIO

Case Western Reserve University

Courses are offered by either the Department of Macromolecular Science (EMAC) or by the Department of Chemical Engineering (ECHE), as part of a full academic program for B.S., M.S., or Ph.D. degrees in Macromolecular Science and Engineering. Overall coverage of polymer science and engineering includes topics relevant to coatings science and technology, and research projects directly concerned with coatings.

Courses on the 400-level (first and second year graduate students) are often given over the Instructional Television Network (ITN), via VCR cassette, available to students in industry for either audit or academic credit. Call (216) 368-8760, or write ITN, CWRU, Cleveland, OH 44106.

Introduction to Polymer Science (EMAC 270)

An introduction to the science and engineering of large molecules; correlation of molecular structure and properties of molecules in solution and bulk; control of significant structural variables in polymer synthesis; analysis of physical methods for characterization of molecular weight and morphology.

Polymer Analysis Laboratory (EMAC 272)

Experimental techniques in polymer synthesis and characterization; synthesis by free radical emulsion, anionic and condensation polymerization; investigation of polymer structure by X-ray diffraction, electron microscopy, infrared, NMR and circular dichroism spectroscopy; molecular weight determination by light scattering and viscosity measurement; study of chemical and mechanical properties.

Polymer Properties and Design (EMAC 276)

Engineering properties of polymers and their evaluation in terms of selection and design procedures. The relation of properties to the chemical and physical structures of polymers and application conditions.

Polymer Processing and Testing Laboratory (EMAC 372)

Basic techniques for rheological characterization of thermoplastic and thermoset resins; "hands-on" experience with equipment used in polymer processing methods such as extrusion, injection molding, compression molding; techniques for mechanical characterization and basic principles of statistical quality control.

Polymer Engineering (EMAC 376)

Mechanical properties of polymer materials as related to polymer structure and composition. Introduction to melt rheology and electrical, optical, and surface properties of polymers.

Polymer Processing (EMAC 377/477)

Rheological, molecular, structural, engineering, and compounding factors affecting processibility and properties of polymers; principles and procedures for extrusion, melting, calendering, injection molding, coatings and other primary processing methods. Considerations of pertinent mechanisms and theories with emphasis on the application of theory to practice.

Polymer Production and Technology (EMAC 378)

Engineering operations for industrial polymerization procedures. Finishing and fabrication of polymers, production and technology of plastics, elastomers, fibers, and coatings.

Macromolecular Synthesis (EMAC 470)

The organic chemistry of macromolecules. The mechanisms of polyreactions, the preparation of addition, condensation and biopolymers, and the chemical reactions of polymers.

Physical Chemistry of Macromolecules (EMAC 472)

The major areas of the physical chemistry of macromolecules are treated: theories and experimental methods of polymer solutions, physical methods for determination of chemical structure and configuration.

Macromolecular Physics (EMAC 474)

Introduction to the physics of amorphous and crystalline polymers. Equilibrium elastic properties of rubbery materials. Viscoelasticity. The liquid-glass and glass-glass transitions. The morphology, characterization and deformation behavior of crystalline polymers.

Applied Macromolecular Science and Engineering (EMAC 476)

Properties, processing and technology of plastics, elastomers, fibers, films, and coatings. The mechanical behavior of polymers related to polymer structure and composition.

X-ray Crystallography (EMAC 479)

A basic description of the scattering of X-rays by crystalline and semicrystalline solids including polymers. Techniques of structure analysis.

Polymer Morphology (EMAC 480)

Morphology of semicrystalline and amorphous polymers, fibers, blends, liquid crystalline polymers, and composites; physical and chemical mechanisms that control morphology; practical knowledge of optical and electron microscopy: lab experiments and a project are included.

Polymer Composite Processing (EMAC 481)

Factors affecting the selection of composite processing methods. Characteristics and applications of compression, injection and reinforced injection molding of composites. Filament winding and pultusion methods.

Fundamentals of Adhesives, Sealants, and Coatings (EMAC 482)

The principles of film formation, film application methods, and related fabrication factors and procedures. Relevant adhesion theories and practices, aspects of rheological treatments, optical and other factors that affect applications. The nature and properties of constituent polymer materials, pigments, solvents, and other additives. Selection and design of systems for mechanical, surface environmental resistance, and other properties.

Macromolecular Synthesis II (EMAC 570)

A series of advanced topics in methods and mechanisms of polymerization of synthetic and biopolymers. Coordination, emulsion, ionic and topochemical polymerizations. Novel polymerization methods.

Physical Chemistry of Macromolecules II (EMAC 572)

A series of advanced topics in the physical chemistry of polymers, including conformational statistics of flexible chains, optical properties of polymers, and the physical chemistry of biological materials and systems.

Polymer Rheology (EMAC 575)

A systematic study of deformation and flow of matter, with emphasis on polymeric and colloidal systems. Topics include rheology of non-Newtonian fluids, the flow properties of simple fluids and dispersions, linear viscoelasticity, polymer solutions and melts, and applications to processing of polymers.

Selected Topics in Macromolecular Synthesis (EMAC 670); Physics (EMAC 671); Physical Chemistry (EMAC 672); Special Topics (EMAC 690)

Content varies depending on the interests of the students and faculty. The topics presented represent advanced and special topics at the forefront of the science and engineering of polymers and polymeric systems. Courses are given on a demand basis.

Characterization of Macromolecules (EMAC 678)

Laboratory experience is gained with the synthesis and characterization of polymers. Methods used include light scattering, viscosity infrared, circular dichroism, and NMR spectroscopy. Solid samples are characterized by X-ray diffraction, electron microscopy, and differential thermal analysis.

The Scientist in the Industrial Environment (EMAC 691)

Course conducted on a seminar basis, focusing on how R&D management plans, justifies and operates within the corporate structure and the areas that R&D encounters in so doing—finance, law, purchasing, manufacturing, marketing, and environmental control.

Surfaces and Adsorption (ECHE 464)

The structure of interfaces including 2-D symmetry, the thermodynamics of interfaces, nature of interactions across phase boundaries, wetting, spreading and surface energetics, adsorption on liquid and solid substrates, properties of adsorbed films, and instrumental methods in surface science.

Colloid Science (ECHE 466)

Stochastic processes and interparticle forces in colloidal dispersions. DLVO theory, stability criteria, and coagulation kinetics. Electrokinetic phenomena. Applications to electrophoresis, filtration, flotation, sedimentation, and suspension rheology. Investigation of suspensions, emulsions, gels, and association colloids.

Environmental Effects on Materials Behavior (EMSE 411)

Aqueous corrosion; principles and fundamental concepts recognition of modes; monitoring and testing methods for control and prediction. Applications of engineering problems, design, and economics. Mixed potential theory, principles of production, hydrogen effects, and behavior in metal systems.

Courses also are offered in: Polymers in Medicine (EMAC 471); Biopolymers (EMAC 473); and Characterization of Biopolymers (EMAC 475).

Contact: Charles E. Rogers, School of Engineering, Dept. of Macromolecular Science, Case Western Reserve University, Cleveland, OH 44106; (216) 368-6376; Fax: (216) 368-4202; E-mail: cer@po.cwru.edu.; or John C. Weaver (216) 368-4494; Fax: (216) 368-4202. For further information see the Internet: http://k2.scl.cwru.edu/cse/emac/.

The Center for Professional Advancement

Microencapsulation and Particle Coating (9804-410)—April 20-22, 1998, Cincinnati, OH

This three-day course will provide an up-to-date assessment of available encapsulation techniques. The aim of the course is to provide an understanding of the unique advantages and difficulties of each major microencapsulation technique. Cost: $1,035.

Contact: Registrar, The Center for Professional Advancement, 144 Tices Lane, P.O. Box 1052, East Brunswick, NJ 08816; (732) 613-4500; Fax (732) 238-9113.

Cleveland Society for Coatings Technology and Pittsburgh Society for Coatings Technology

Manufacturing Day—April 22, 1998, Cleveland Airport Marriott, Cleveland, OH

Complete guided tour of the ICI/Glidden paint manufacturing plant in Huron, OH, followed by a dinner meeting and speaker - topic will be manufacturing orientated in keeping with the ever changing manufacturing requirements. Cost: $65. Both Manufacturing Day and Symposium - $200.

41st Annual Technical Symposium: Waterborne Coatings: Sink or Swim II—April 23-24, 1998, Cleveland Airport Marriott, Cleveland, OH

This two day symposium offers the opportunity to listen to 13 speakers on waterborne technologies and see 50 plus table top displays. Cost: $150. Both Symposium & Manufacturing Day - $200.

Contact: Vicki Fisher, Jamestown Paint Co., 108 Main St., Jamestown, PA 16134; (412) 932-3101; Fax: (412) 932-3295.

Kent State University and Professional Development Institute

Introduction to Coatings Technology—April 14-17, 1998, Kent State University, Kent, OH

An introductory course designed to help technical and non-technical newcomers understand the coatings industry, its challenges and opportunities. The course will cover the evolution of coatings technology and the progress the coatings industry is making in its rapid change from art to science. It will present the specialized language of the industry and will cover many raw materials and their functions in both architectural and industrial finishes. Some time will be spent on regulatory restrictions, economic forces, and other factors that influence the composition and performance of coatings. Formulation of coatings and basic, simple calculations will be discussed. Cost: $690.

Applied Rheology for Industrial Chemists—April 20-24, 1998

Aimed at providing practitioners in the coatings, adhesives, elastomers, and plastics industries with insights which will enable them to write and understand specifications, improve quality control, and learn techniques in rheology. The course covers subjects related to rheology,

kinematics and dynamics, dispersion, interfacial and polymer rheology, with discussions divided equally between principles and application. Fee: $875.

Dispersion of Pigments and Resins in Fluid Media—May 11-15, 1998

The chemistry and mechanical aspects of the dispersion of pigments and resins in fluid media are discussed. Subjects covered include: theoretical underpinnings of dispersion, ranging from fundamentals of dispersion preparation and modification to stabilization. Practical consequences are shown, followed by expert presentation on the operation of a variety of dispersion equipment and plant practice. Fee: $875.

Adhesion Principles and Practice for Coatings and Polymer Scientists—May 4-8, 1998

This course is designed for industrial scientists and technologists who encounter adhesion problems. Common problems are addressed through theoretical treatments. Closely allied with coatings, as well as rheology, the subject of adhesion is addressed by topics ranging from principles of bonding to surface chemistry, to a wide variety of mechanical properties. Adhesion principles are discussed first, then applied problems that have been solved in the industrial and academic settings. Fee: $875.

Surface Chemistry (Chemistry 4057l)—15 Weeks.

Theory and behavior of inorganic and organic colloidal dispersions and their applications to industrial chemistry. Viscosity sedimentation, diffusion, organics, donnan equilibrium, light scattering, surface tension, absorption, wetting, electrical phenomena. Van Der Waals forces, double layer theory and electrophoresis.

Physical Chemistry of Macromolecules (Chemistry 40583)—15 Weeks.

An introduction to the physical chemistry of macromolecules. Subjects: molecular forces and bonding, conformation, thermodynamics, molecular weights, collegative properties, light scattering, viscosity, spectroscopy, mechanical properties, rheology and mass transitions.

Contact: Carl J. Knauss, Professional Development Institute, P.O. Box 1792, Kent, OH 44240; (330) 673-6993; Fax: (330) 672-3816.

NACE International (National Association of Corrosion Engineers)

Basic Corrosion—September 27-October 2, 1998, Cincinnati, OH

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Coatings Inspection Training & Certification-Session I—September 27-October 2, 1998, Cincinnati, OH

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

The Society for Protective Coatings (SSPC)

Fundamentals of Protective Coatings (C-1)—September 14-18, 1998, Cincinnati, OH

This five-day course provides a practical overview of the issues and concerns affecting coatings operations with the latest information on corrosion, surface preparation and coatings application, quality control, and the total protective coatings program. Cost: $775 member; $860 nonmember.

Specifying and Managing Protective Coatings Projects (C-2)—September 14-18, 1998, Cincinnati, OH

This five-day course on how to become efficient and cost-effective when specifying and managing coatings projects covers standards and specification development, management of maintenance painting, working with the contractor, coating failure, and maintaining safety on the job. Cost: $775 member; $860 nonmember.

Supervisor/Competent Person Training for Deleading of Industrial Structures (C-3)—September 14-18, 1998, Cincinnati, OH

This is a four-day course. Comprehensive round-ups on lead abatement basics such as regulations, safety and health hazards, and legal insurance issues are balanced with hands-on workshops in which you actually practice typical duties encountered on the job. Cost: $775 member; $860 nonmember.

Supervisor/Competent Person Refresher Training for Deleading of Industrial Structures (C-5)—September 14-18, 1998, Cincinnati, OH

This one-day course provides refresher training for supervisor/competent persons responsible for the deleading of industrial structures. The course meets the requirements of those state programs which require refresher training to maintain supervisor certification. Cost: $225 member; $260 nonmember.

Contact: Philip Cynar, SSPC, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656; (412) 281-2331 ext. 121; Fax: (412) 281-9993; E-Mail: cynar@sspc.org.

OKLAHOMA

NACE International
(National Association of Corrosion Engineers)

Basic Corrosion—February 16-20, 1998, Tulsa, OK

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Basic Protective Coatings & Linings— February 16-20, 1998, Tulsa, OK

This course provides training on the fundamentals of protective coatings and linings, the application of basic coating systems, general information on the use of coatings systems, and why they are used for corrosion control. This course gives attendees a thorough understanding of the what, when, how, and where of protective coatings.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

PENNSYLVANIA

Emulsion Polymers Institute, Lehigh University

Advances in Emulsion Polymerization and Latex Technology—June 1-5, 1998, Sinclair Laboratory Auditorium, Lehigh University, Bethlehem, PA

This one week course is an in-depth study of the synthesis, characterization, and properties of high polymer latexes. The subject matter includes a balance of theory and applications as well as a balance between chemical and physical problems. Lectures will be given by leading academic and industrial workers. Lectures will begin with introductory material and reviews, and will progress through recent research results. Cost: $1,000 - course or $350 per day for any portion of the course attended

Contact: Debra H. Nyby, Administrative Associate, Lehigh University, 111 Research Dr., Iacocca Hall D330, Bethlehem, PA 18015-4732; (610) 758-3590; Fax: (610) 758-5880.

NACE International
(National Association of Corrosion Engineers)

Basic Corrosion—April 19-24, Philadelphia, PA

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Coatings Inspection Training & Certification-Session I—April 19-24, 1998, Philadelphia, PA

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Coatings Inspection Training & Certification-Session II—April 19-24, 1998, Philadelphia, PA

Training Session II focuses on shop coating processes for steel, advanced inspection techniques, and introduces more sophisticated nondestructive and destructive tests and test instruments than those covered in Session I. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

Paint & Decorating Retailers Association (PDRA)

Certified Paint Consultant—March 4, 1998, Philadelphia, PA

This course will show you how to guide customers to the proper type of architectural coatings for their particular project, provide instructions on surface preparation and coatings application, ensure customers have all the tools and sundries needed for DIY projects, demonstrate the value of using quality products, recognize and resolve common coatings problems, advise customers on color and how to decorate with coatings, and sell more paint. Cost: $129 PDRA members; $189 nonmembers.

Contact: Margi Barnes, PDRA, 403 Axminister Dr., Fenton, MO 63026; (800) 737-0107; Fax: (314) 326-1823.

Philadelphia Society for Coatings Technology

Eastern Training Conference and Show—May 11-14, 1998, Valley Forge Convention Plaza, King of Prussia, PA

This three and one-half day introductory course is aimed

at an increased understanding of coatings for both technical and non-technical personnel. The course will cover the essentials of coatings technology and chart the course the industry is taking in its accelerated evolution towards an exact science. Attendees will learn the language of the industry and further their understanding of how raw materials function in both architectural and industrial finishes. Topics will range from simple calculations and basic formulations all the way to the driving forces that influence coating compositions. Participants in the course will receive a compilation of notes. Cost: $275 (includes all luncheons).

Contact: Wayne A. Kraus, Hercules Research Center, 8136/319, 500 Hercules Rd., Wilmington, DE 19808; (302) 995-3435; Fax: (302) 995-4669.

SOUTH CAROLINA

Institute of Materials Science at New Paltz

Polymer Degradation and Stabilization—February 28-March 1, 1998, Hilton Head Island, SC

The objective of this two-day course is to acquaint scientists and engineers with the basic concepts of polymer degradation, testing, and stabilization, and to review the current status and latest advances in the stabilization of key commercial polymers and elastomers. Special emphasis will be given to the theory and practice of accelerated thermal and weathering test methods and their use to make lifetime predictions. Cost: Advanced Fee - $895; after February 2 - $1,100.

Pigment Dispersion: Science & Technology—March 9-12, 1998, Hilton Head Island, SC

This four-day course examines in depth the principles of colloids that are relevant to the various stages - incorporation, wetting, disagglomeration, flocculation - involved in the overall process of dispersing pigments into liquid media and their technological application. It will be of significant interest to anyone who encounters in their work the unique effects that colloid and interface science exert on the properties of pigment dispersion and seeks an improved understanding of the processes involved. Cost: Advanced fee - $1,200; after February 9 - $1,350.

Introduction to Emulsion Polymers/Polymer Colloids—March 9-11, 1998, Hilton Head Island, SC

The purpose of this three-day course is to make complex systems and concepts related to polymer emulsions and colloids understandable and applicable to industrial scientists and engineers. Recent developments and practical applications will be discussed related to waterborne synthetic latexes and their importance in non-polluting paints, adhesives, printing inks, and floor polishes as well as other uses. This course is designed for the industrial researcher who is entering the field or who has been working in the field and is looking to solve particular problems. Discussion is considered essential to the course. Cost: Advanced Fee - $995; after February 9 - $1,150.

Contact: Angelos V. Patsis, Director, Institute of Materials Science, State University of New York at New Paltz, New Paltz, NY 12561; (914) 255-0757; Fax: (914) 255-0978.

North Dakota State University

Environmentally Compliant Coatings—January 20-23, 1998, Crown Plaza Resort, Hilton Head Island, SC

Increasing environmental concerns and current EPA regulations force coatings industry to use less polluting chemicals. This course focuses on all aspects of environmentally compliant chemicals used in coatings technology. The course will be taught at a research level with emphasis on how organic, physical, and polymer chemistry concepts are being applied to practical coatings problems. Recent developments will be emphasized. Topics change each year, but will focus on: modern aspects of waterborne and latex coatings; powder coatings; radiation curing; high solids; rheology of clear and pigmented coatings; analysis of coatings; crosslink density; PVC/CPVC; and Corrosion. Cost: $850

Contact: Dr. Marek W. Urban, Course Director, or Deborah Shasky, Program Coordinator, NDSU - Polymers & Coatings Dept., 54 Dunbar Hall, Fargo, ND 58105; (701) 231-7633; Fax (701) 231-8439; E-mail: nupoly@plains.nodak.edu.

TENNESSEE

Paint & Decorating Retailers Association (PDRA)

Certified Paint Consultant—February 15, 1998, Nashville, TN

This course will show you how to guide customers to the proper type of architectural coatings for their particular project, provide instructions on surface preparation and coatings application, ensure customers have all the tools and sundries needed for DIY projects, demonstrate the value of using quality products, recognize and resolve common coatings problems, advise customers on color and how to decorate with coatings, and sell more paint. Cost: $129 PDRA members; $189 nonmembers.

Industrial Paint and Coatings Consultant—February 15, 1998, Nashville, TN

This course offers in-depth training on: a market overview of the profitable industrial/specialty coatings field, basic coatings chemistry, product usage, corrosion theory, surface preparation, types of coatings failures, testing, and application methods. Cost: $129 PDRA members; $189 nonmembers.

Contact: Margi Barnes, PDRA, 403 Axminister Dr., Fenton, MO 63026; (800) 737-0107; Fax: (314) 326-1823.

TEXAS

NACE International (National Association of Corrosion Engineers)

Internal Coatings: Why, Which, & How—February 1998, Houston, TX

An expanded version of the highly successful "FBE" TechEdge conducted last year, this TechEdge will focus on the role of Fusion Bonded Epoxy and Liquid Systems on corrosion control, scale control, paraffin control and increasing flow efficiency in oil, gas and water produc-

tion and transportation systems. Discussions on various corrosion processes including sweet corrosion, sour corrosion and erosion corrosion will be covered, as well as a tour of a coating application facility.

Basic Protective Coatings & Linings—September 13-18, 1998 and November 29-December 4, 1998, Houston, TX

This course provides training on the fundamentals of protective coatings and linings, the application of basic coating systems, general information on the use of coatings systems, and why they are used for corrosion control. This course gives attendees a thorough understanding of the what, when, how, and where of protective coatings.

Advanced Protective Coatings & Linings—September 20-25, 1998, Houston, TX

The advanced coatings and linings course will focus on specialized protective coatings and linings including cladding, rubber linings, powder coatings, glass linings, flamespray, cooling and plating, and concrete. This advanced course will also provide detailed information on coatings for non-steel substrates, project management, predicting coating life, and quality assurance.

Basic Corrosion—March 1-6, 1998, March 8-13, 1998 and June 7-12, 1998, September 13-18, 1998, September 20-25, 1998, Houston, TX

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Coatings Inspection Training & Certification-Session I—March 1-6, 1998, March 8-13, 1998, June 7-12, 1998, June 14-19, 1998, September 20-25, 1998, November 29-December 4, 1998, and December 6-11, 1998, Houston, TX

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Coatings Inspection Training & Certification-Session II—March 8-13, 1998, September 20-25, 1998, and December 6-11, 1998, Houston, TX

Training Session II focuses on shop coating processes for steel, advanced inspection techniques, and introduces more sophisticated nondestructive and destructive tests and test instruments than those covered in Session I. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Coatings Inspection Training & Certification-Session III—March 8-12, 1998, and December 6-10, 1998, Houston, TX

Training Session III covers specialized application methods and substrates other than steel. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Peer Review—March 13-14, 1998 and December 11-12, 1998, Houston, TX

Peer Review is an intensive, detailed oral examination of the candidate for recognition. The Peer Review lasts approximately two hours and covers practical and theoretical knowledge. Work experience verification documentation is required. Upon successful completion of Sessions I, II, and III, and the Peer Review, the participant will have attained Certified NACE Coating Inspector recognition. Advance Fees (North America): NACE members $625; nonmembers $750; Standard Fees (North America) NACE members $725; nonmembers $850; Outside North America: NACE members $1,075; nonmembers $1,200.

Marine Coatings Inspection—December 3-5, 1998, Houston, TX

This three-day marine coating inspection training program will cover the fundamental issues that are specific to coatings in worldwide marine environments. Types of coatings that are effective, surface preparation, application and inspection techniques, international regulations and standards and environmental issues will be discussed. This course has been developed by a broad spectrum of industry experts (including representatives from international marine coating companies, shipyard personnel and ship owners and operators), bringing proven strategies and know-how to the course content. Fees: NACE member $775; nonmember $895.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

The Society for Protective Coatings (SSPC)

Fundamentals of Protective Coatings (C-1)—February 23-27, 1998, Houston, TX

This five-day course provides a practical overview of the issues and concerns affecting coatings operations with the latest information on corrosion, surface preparation and coatings application, quality control, and the total protective coatings program. Cost: $775 member; $860 nonmember.

Specifying and Managing Protective Coatings Projects (C-2)—February 23-27, 1998, Houston, TX

This five-day course on how to become efficient and cost-effective when specifying and managing coatings projects covers standards and specification development, management of maintenance painting, working with the contractor, coating failure, and maintaining safety on the job. Cost: $775 member; $860 nonmember.

Supervisor/Competent Person Training for Deleading of Industrial Structures (C-3)— February 23-27, 1998, Houston, TX

This is a four-day course. Comprehensive round-ups on lead abatement basics such as regulations, safety and health hazards, and legal insurance issues are balanced with hands-on workshops in which you actually practice typical duties encountered on the job. Cost: $775 member; $860 nonmember.

Supervisor/Competent Person Refresher Training for Deleading of Industrial Structures (C-5)—February 23-27, 1998, Houston, TX

This one-day course provides refresher training for supervisor/competent persons responsible for the deleading of industrial structures. The course meets the requirements of those state programs which require refresher training to maintain supervisor certification. Cost: $225 member; $260 nonmember.

Contact: Philip Cynar, SSPC, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656; (412) 281-2331 ext. 121; Fax: (412) 281-9993; E-Mail: cynar@sspc.org.

VIRGINIA

Inter-Society Color Council (ISCC)

Color and Design: 21st Century Technology and Creativity—February 22-24, 1998, Williamsburg, VA

Contact: Robert T Marcus, D&S Plastics International, 100 S. Mitchell Road, Mansfield, TX 76063.

WASHINGTON

NACE International (National Association of Corrosion Engineers)

Coatings Inspection Training & Certification-Session I—October 18-23, 1998, Seattle, WA

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

Pacific Northwest Society for Coatings Technology

51st Annual Technical Symposium (Maximizing Performance Properties and Minimizing Production Problems of Waterborne Coatings)—April 30, May 1-2, 1998, Doubletree Motel at the Quay, Vancouver, WA

The technical program will include papers on raw materials to improve waterborne coatings performance and production and formulating techniques to minimize manufacturing problems. Cost: Registration, $100; Spouses program, $65; Thursday night social, $65; Golf, $65.

Basic Coatings Raw Materials for Production Person—February 17, 1998, location to be announced

This half-day course, sponsored by the Portland Section, is an introduction to the basic raw materials used in coatings formulation and is aimed at familiarizing batchmatchers, production personnel and non-technical personnel with coatings raw materials. Cost: $45 (includes dinner).

Contact: Deborah Severson, Miller Paint Co., 12730 NE Whitaker Way, Portland, OR 97230; (503) 255-0190; Fax: (503) 255-0192.

The Society for Protective Coatings (SSPC)

Fundamentals of Protective Coatings (C-1)—May 4-8, 1998, Tacoma/Seattle, WA

This five-day course provides a practical overview of the issues and concerns affecting coatings operations with the latest information on corrosion, surface preparation and coatings application, quality control, and the total protective coatings program. Cost: $775 member; $860 nonmember.

Specifying and Managing Protective Coatings Projects (C-2)—May 4-8, 1998, Tacoma/Seattle, WA

This five-day course on how to become efficient and cost-effective when specifying and managing coatings projects covers standards and specification development, management of maintenance painting, working with the contractor, coating failure, and maintaining safety on the job. Cost: $775 member; $860 nonmember.

Contact: Philip Cynar, SSPC, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656 (412) 281-2331 ext. 121; Fax: (412) 281-9993; E-Mail: cynar@sspc.org.

International

AFRICA

Oil & Colour Chemists' Association (OCCA)

Coatings for Africa '98—March 6-8, 1998, International Convention Centre, Durban, South Africa

Contact: Christopher Pacey-Day, OCCA 967 Harrow Road, Wembley, Middlesex, England HA0 2SF.

AUSTRALIA

Surface Coatings Association Australia (SCAA)

Certificate of Surface Coatings Technology—February–November 1998, Western Melbourne Institute of TAFE, Melbourne, Australia

This course aims to provide a specialized knowledge of coatings technology. Units cover raw materials, formulation and equipment, technical management, health and safety, coatings types, printing inks, testing and analysis. The course is particularly suitable for graduate scientists who are new to the coatings industry. Cost: A$948.

Contact: Michael Beresford, Dulux Australia, P.O. Box 60, Clayton South, Victoria 3169, Australia; (61) 3 9263-9229; Fax: (61) 3 9263-5067.

Introduction to Coatings Technology - Certificate—March–November 1998, Western Melbourne Institute of TAFE, Melbourne, Australia

This course aims to provide a basic understanding of the theory, composition, materials and properties of paint and surface coatings. It is particularly suitable for those employed in the application, manufacture, sales and testing of paints and coatings. Cost: A$550.

Contact: Charles Eade, 4 Little Union St., Brighton East, Victoria 3187, Australia; (61) 3 9592-4550; Fax: (61) 3 9553-8310.

Surface Coatings Technology—February–November 1998, Meadowbank College of TAFE, Meadowbank College of TAFE, Sydney, Australia

This course is provided for chemical technicians working in the coatings industry. It covers the polymers used in all types of paints and printing inks. Cost: A$180.

Basic Surface Coatings—August-November 1998, Sydney, Australia

The course aims to increase the basic technical knowledge of those new to the coatings industry. Topics are: history of paints, raw materials, occupational health and safety, decorative paints, industrial paints, system selection, complaints and rectification. Cost: A$85.

Contact: Brian Fisher, Chemical Technology Section, Meadowbank College of TAFE, Meadowbank, NSW 2114, Australia; (61) 2 9844-3612.

Surface Coatings Association, Inc., New Zealand, (SCANZ) and Surface Coatings Association, Australia, Inc. (SCAA)

Coatings for the Future—July 29-August 1, 1998, Carlton Hotel, Aukland, New Zealand

Contact: 98 Transtas Conference, P.O. Box 5192, Wellesley Street, Auckland, New Zealand.

CANADA

Montreal Society for Coatings Technology

Industrial Coating Formulation—November 16-18, 1998, Dorval's Holiday Inn, Montreal, Canada

This is a three-day in-depth study of industrial finishes formulation. Cost: $250 for the three days, lunches included.

Contact: Marc Gagnon, Colorspec Inc., 467 bl. Marc-Aurele Fortin, Laval, Que., H7L 5E6 Canada; (514) 628-3698; Fax: (514) 963-1941.

NACE International (National Association of Corrosion Engineers)

Basic Corrosion—February 22-27, 1998, and September 13-18, 1998, Vancouver, BC

This course will teach you how to identify potential problems and communicate effectively with other corrosion professionals. It provides a basic but thorough review of the theoretical and practical elements of controlling corrosion. Participants learn the causes of corrosion and the methods by which it can be identified, monitored, and controlled. Hands-on experiments and case studies, in addition to lecture and discussion format, enhance learning and retention. Active participation is encouraged and ample time is given for question and answer periods. Advance fees: NACE members $695, nonmembers $820; Standard fees: NACE members $795, nonmembers $920.

Coatings Inspection Training & Certification-Session I—March 29-April 3, 1998, Toronto, ON and September 13-18, 1998, Vancouver, BC

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Coatings Inspection Training & Certification-Session II—March 29-April 3, 1998, Toronto, ON and September 13-18, 1998, Vancouver, BC

Training Session II focuses on shop coating processes for steel, advanced inspection techniques, and introduces more sophisticated nondestructive and destructive tests and test instruments than those covered in Session I. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Coatings Inspection Training & Certification-Session III—March 29-April 2, 1998, Toronto, ON and September 13-17, 1998, Vancouver, BC

Training Session III covers specialized application methods and substrates other than steel. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Peer Review—April 3-4, 1998, Toronto, ON, and September 18-19, 1998, Vancouver, BC

Peer Review is an intensive, detailed oral examination of the candidate for recognition. The Peer Review lasts approximately two hours and covers practical and theoretical knowledge. Work experience verification documentation is required. Upon successful completion of Sessions I, II, and III, and the Peer Review, the participant will have attained Certified NACE Coating Inspector recognition. Advance Fees (North America): NACE members $625; nonmembers $750; Standard Fees (North America) NACE members $725; nonmembers $850; Outside North America: NACE members $1,075; nonmembers $1,200.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

Paint & Decorating Retailers Association (PDRA)

Certified Paint Consultant— February 20, 1998, Toronto, Ont. And April 7, 1998, Montreal, Que.

This course will show you how to guide customers to the proper type of architectural coatings for their particular project, provide instructions on surface preparation and coatings application, ensure customers have all the tools and sundries needed for DIY projects, demonstrate the value of using quality products, recognize and resolve common coatings problems, advise customers on color and how to decorate with coatings, and sell more paint. Cost: $129 PDRA members; $189 nonmembers.

Contact: Margi Barnes, PDRA, 403 Axminister Dr., Fenton, MO 63026 (800) 737-0107; Fax: (314) 326-1823

Toronto Society for Coatings Technology

Three Semester Program in Coatings Technology (Semester 1–Coatings Raw Materials; Semester 2–Trade Sales and Architectural Coatings; Semester 3–Industrial Coatings)—Winter Session (Semester 3)–January-April 1998; Fall Session (Semester 1)–September-December 1998, The George Brown College of Arts and Technology, Toronto, Ontario, Canada

Semester 1 covers basic chemistry, manufacturing, testing and selection of all major coatings raw materials. Semester 2 covers formulation, manufacturing and testing of trade sales and architectural coatings. Semester 3 covers manufacturing, testing and application of industrial coatings, equipment and surface preparation. Duration is 14 weeks. Three hour lectures held one evening per week. Cost: $400 per student per semester (includes textbook).

Contact: Walter Fibiger, ITE Consultants, 86 Castlebury Cr. Unit 17, Willowdale, Ontario, M2H 1W8, Canada; (416) 490-9314; Fax: (416) 490-1738.

ITALY

11th International Symposium on Polymer Analysis and Characterization (ISPAC-11)—May 25-27, 1998, Santa Margherita Ligure, Genoa, Italy

Contact: Oscar Chiantore, Dept. of Chemistry IPM, University of Torino, Via Giuria 7-101025 Torino, Italy Fax: 39 11 670 7855

MEXICO

Instituto Mexicano de Tecnicos en Pinturas y Tintas (IMTPYT)

Technical Conferences—January–June and August-September, 1998, Gabriel Mancera 309, Mexico

Two hour technical talks held twice a month to promote and develop the paint and ink industry.

Coatings Graduate at Universidad Nacional Autonoma de Mexico—January to June 1998, Mexico

Contact: Jose L. Ramirez, Gabriel Mancera 309, Col. Del Valle, 03100 Mexico, D.F. 525-682-7794; Fax: 525-543-6488

Federation of Societies for Coatings Technology (FSCT) and Mexico Paint Manufacturers Association (ANAFAPYT), and IMTPYT

1998 Panamerican Coatings Expo—July 23-24, 1998, World Trade Center, Mexico City, Mexico

FSCT along with ANAFAPYT and the Mexiso Society, will hold its second Panamerican Coatings Expo for the Mexican coatings industry. A one-day seminar will be conducted during the event.

Contact: Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422; (610) 940-0777; Fax: (610) 940-0292; http://www.coatingstech.org.

THE NETHERLANDS

The Center for Professional Advancement

Additives for Coatings—November 1998, The Netherlands

This three-day course will serve as an introduction to, and study of, additives which are the basic tools used in the development of paints, coatings, inks and plastics.

The chemical make-up of additives, the way in which they function, and their purpose and methods of incorporation, will be covered. The discussions of usage will be paint oriented; however, analogies to other areas will be included. Cost: $1435.

Microencapsulation and Particle Coating (9801-301)—January 12-14, 1998

This three day program will provide an up-to-date assessment of available encapsulation techniques. The aim is to provide an understanding of the unique advantages and difficulties of each major microencapsulation technique. Cost: $1435.

Powders: Their Properties and Processing—October 1998, The Netherlands.

The primary purpose of this three or four day course is to review the various properties of powdered solids pertinent to the development and manufacture of the products of the pharmaceutical, cosmetic and allied industries. In particular, the latest experimental techniques and equipment for evaluating important properties of powders will be discussed and related to both the underlying theory and common industrial problems. Cost: $1460/3 days; $1750/4 days.

Powder Mixing Technology (9804-203)—April 4-6, 1998, The Netherlands

This three-day course presents the principles and techniques of mixing free-flowing or cohesive powders. Selection of suitable industrial equipment for particular mixing duties will be discussed analyzing mixer performance in terms of process advantages, mixture quality and the flexibility of the mixer for multi-product manufacture. Cost: $1525.

Contact: Registrar, The Center for Professional Advancement, Oudezijds Voorburgwal 316A, 1012 GM Amsterdam, The Netherlands 31 20 6382806; Fax: 31 20 6202136

TECHNOLOGY PUBLISHING COMPANY

PCE '98—April 1-3, 1998, The Netherlands Congress Centre, The Hague, The Netherlands

The theme for this year's conference and exhibition for protective and marine coatings is: "Achieving Cost-Effectiveness in Coatings Work." This is articulated in 42 conference presentations that deal with selecting and specifying coatings, creating strong maintenance painting programs, and controlling the cost of surface preparation and other components of coating work. The theme is carried out in two conference tracks running simultaneously, one on protective coatings and one on marine coatings. Cost: $400.

Contact: Harold Hower, PCE, 2100 Wharton St., Pittsburgh, PA 15203 (412) 431-8300; Fax: (412) 431-5428

SAUDI ARABIA

NACE INTERNATIONAL
(NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

Coatings Inspection Training & Certification-Session I—March 7-12, 1998, Dammam, Saudi Arabia

Training Session I is an intensive presentation of the basic technology of coating application and inspection. The session involves a full 60 hours of instruction and practice. The objectives are to give the inspector trainee the knowledge and skills necessary for most typical inspection work on structural steel coatings projects. Students should bring work clothes and sturdy work shoes to wear to the practice lab, which includes blasting and painting. Advance Fees (North America): NACE members $1,675; nonmembers $1,800; Standard Fees (North America) NACE members $1,775; nonmembers $1,900; Outside North America: NACE members $2,075; nonmembers $2,200.

Coatings Inspection Training & Certification-Session II—March 14-18, 1998, Dammam, Saudi Arabia

Training Session II focuses on shop coating processes for steel, advanced inspection techniques, and introduces more sophisticated nondestructive and destructive tests and test instruments than those covered in Session I. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Coatings Inspection Training & Certification-Session III—March 21-25, 1998, Dammam, Saudi Arabia,

Training Session III covers specialized application methods and substrates other than steel. Advance Fees (North America): NACE members $875; nonmembers $1,000; Standard Fees (North America) NACE members $975; nonmembers $1,100; Outside North America: NACE members $1,275; nonmembers $1,400.

Peer Review—March 26-27, 1998, Dammam, Saudi Arabia

Peer Review is an intensive, detailed oral examination of the candidate for recognition. The Peer Review lasts approximately two hours and covers practical and theoretical knowledge. Work experience verification documentation is required. Upon successful completion of Sessions I, II, and III, and the Peer Review, the participant will have attained Certified NACE Coating Inspector recognition. Advance Fees (North America): NACE members $625; nonmembers $750; Standard Fees (North America) NACE members $725; nonmembers $850; Outside North America: NACE members $1,075; nonmembers $1,200.

Contact: NACE Registrar, 1440 South Creek Drive, Houston, TX 77084-4906; (281) 228-6285; Fax: (281) 228-6329; E-mail: msd@mail.nace.org.

UNITED KINGDOM

COUNCIL FOR OPTICAL RADIATION MEASUREMENT AND THE ULTRAVIOLET SPECTROMETRY GROUP

Third Oxford Conference on Spectrometry—June 28-July 2, 1998, Royal Holloway College of the University of London, Egham, Surrey, United Kingdom.

Contact: Art Springsteen, Third Oxford Conference, c/o Labsphere, Inc., P.O. Box 70, Shaker Street, North Sutton, NH 03260.

Index

What Do These Terms Have In Common?

ACETYLATED CONGO S.B.P. SPIRITS SAGGING

They can all be found in the NEW Coatings Encyclopedic Dictionary

Editor: Stanley LeSota

This is the world's most up-to-date, comprehensive, authoritative reference for the language of *YOUR INDUSTRY.*

- ➤ Over 6,000 industry terms defined
- ➤ Cross referenced for synonyms and related categories
- ➤ Current industry vocabulary, including state-of-the-art technologies and regulatory terms
- ➤ Quick, clear references for technical, as well as commonly used industry terms

This is a MUST HAVE resource for *anyone* working in the paint, coatings, ink, art, visual and related industries. Perfect for marketing, sales, R&D, chemists, government and regulatory workers, artists, architects, manufacturers, technicians, teachers, students and more. Developed and approved by the Federation of Societies for Coatings Technology.

Call 610-940-0777
Fax 610-940-0292
Or use the order form below.

CALL NOW TO RESERVE YOUR NEW EDITION! 610-940-0777

YES! Send me the *NEW EDITION* of the *COATINGS ENCYCLOPEDIC DICTIONARY NOW!*
Please refer to #JC0298 when ordering

		Soft Cover	Hardback
Number of Copies ____	Federation Members	$80*	$105*
	Non-Members	$105*	$135*

I am paying by: ❑ Check or money order ❑ Company Purchase Order (please attach)
❑ MasterCard ❑ Visa ❑ American Express

Credit Card Number_____ Exp. Date_____

Signature _____

Company name_____ Attn:_____

Address_____ City/State/Zip _____

Mail to: Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422-2350

*Volume pricing is also available on orders of 5 or more. Please call for more information. Shipping and handling charges and appropriate sales tax (PA 6%) are additional.

Potential Exposure to Bisphenol A from Food-Contact Use of Epoxy Coated Cans

Susan R. Howe—The Society of the Plastics Industry, Inc.*
Lester Borodinsky—Keller and Heckman, LLP†
Roy S. Lyon—National Food Processors Association**

The potential dietary exposure to bisphenol A (BPA) from the use of food and beverage cans coated with bisphenol A-based epoxies was determined. The calculation was based on migration data from extraction studies using food-simulating solvents and time and temperature conditions recommended by U.S. Food and Drug Administration (FDA). The study demonstrates that no detectable BPA was found in the extracts from beverage cans using a method sensitive to five parts per billion (5 ppb) in the food simulant; the average migration of BPA from food cans was determined to be 37 ppb. Using these data, along with the use patterns for food and beverage cans, the maximum potential dietary exposure to bisphenol A was estimated to be approximately 2.2 ppb. Because the conditions of the migration tests exaggerate actual use conditions, this value overstates the reasonably anticipated actual potential exposure.

INTRODUCTION

Epoxy resins have been used as components of coatings for food and beverage cans for more than 50 years. Epoxies based on bisphenol A (BPA)(4,4'-isopropylidenediphenol; 2,2-bis(4-hydroxyphenyl)propane) are cleared by the United States Food and Drug Administration (FDA) for use as the food-contact surface of coated cans;[1] in addition, bisphenol A-based epoxies are permitted for the same use throughout Europe[2] and the Pacific Rim. While the European Union (EU) has established a specific migration limit in food of 3 mg/kg [i.e., 3 parts per million (3 ppm)], FDA has not imposed a comparable limit on BPA.

While analyses to determine the potential migration of BPA from coatings to food simulants have been published, these have not employed collaboratively studied methods nor were they developed to have the necessary performance characteristics for suitable analyses in regulatory food simulants.[3,4]

The present study was conducted to determine the potential migration of BPA from cans coated with BPA-based epoxies. The study, conducted in accordance with the procedures developed by FDA,[5] was performed using food-simulating solvents and time and temperature conditions recommended by FDA. Using the results of the migration study, the potential dietary exposure to BPA was estimated.

Specifically, the postulated dietary consumption of a substance depends on the potential level in food (e.g., a value derived from migration studies) and on the fraction of an individual's diet likely to contact packaging materials containing the substance. FDA employs the term Consumption Factor (CF) to describe the portion of the diet likely to contact specific packaging materials.[5] In addition, to account for the variable nature of food contacting each packaging material, FDA has developed Food-Type Distribution Factors (f_T) for each packaging material to indicate the fraction of the food contacting each material that is aqueous, acidic, alcoholic, and fatty. Using these parameters, along with the experimentally determined potential migration levels, the possible dietary exposure to BPA from the use of epoxy can coatings was determined.

*1801 K St., N.W., Ste. 600K, Washington, D.C. 20006.
†1001 G St., N.W., Ste. 500 West, Washington, D.C. 20001.
**1401 New York Ave., N.W., Ste. 400, Washington, D.C. 20005.

MATERIALS AND METHODS

Preparation of the Samples

Test specimens consisted of commercial cans collected at two different points in time. In both cases, the samples consisted of unused cans obtained from the major can manufacturers in the United States. The types of cans fall into three categories: two-piece beverage/beer cans, two-piece food cans, and three-piece food cans. In all

Table 1—Instrumental Conditions for High Performance Liquid Chromatography (HPLC) Analyses of Bisphenol A (Phase 1, Initial Conditions)

Pump	Hewlett Packard 1050
Autosampler	Hewlett Packard 10
Detector	Hewlett Packard 1046 programmable fluorescence detector
Wavelength	Excitation: 229 nm Emission: 311 nm
Columns	Two Supelco C18 5μ (250 x 4.6 mm) in series
Mobile phase	13.0% methyl alcohol, 44.2% water, and 42.8% acetonitrile
Flow rate	1.0 mL/min isocratic
Column oven temperature	40°C
Injection volume	20 μL

cases, the can samples were selected to maximize the level of BPA-based epoxy present in the coatings.

Two-Piece Beverage/Beer Cans

Coated aluminum beer and beverage cans from three major suppliers were used. While can coatings for beverages and beer are identical from a given supplier, beverage cans were used since the coating weight of beverage cans is slightly greater than that of beer cans. These samples were all "standard" 12-ounce cans supplied by three individual can manufacturers using coating formulations supplied by three different suppliers.

Two-Piece Food Cans

Four types of steel two-piece food cans/coatings were used. The four represent primarily aqueous types of food; a fifth sample, virtually identical to one of the previous four, was used to accomplish two purposes. First, it represents cans used to pack meat products, which are considered fatty foods and, second, it permits the examination of potential hydrolysis of the epoxy coating, since 95% ethanol, a potentially severely aggressive solvent for this application, was used as the food simulant (as described in the following). Thus, a total of five two-piece food can samples was tested. The can sizes were 300 x 407, which may be considered "one-pound" cans, and one 211 x 315 sample. The can samples for fatty foods and one of the can samples for aqueous foods were supplied by the same can manufacturer and used coatings, supplied by the same coating formulator, that were virtually identical, with the exception that the can sample for fatty foods had an approximately 30% greater coating weight than the can sample for aqueous foods. The other three samples were provided by three other can manufacturers using coating formulations supplied by three different suppliers.

Table 2—Instrumental Conditions for High Performance Liquid Chromatography (HPLC) Analyses of Bisphenol A (Phase 1, Addition of Flush Step)

Pump	Hewlett Packard 1050
Autosampler	Hewlett Packard 10
Detector	Hewlett Packard 1046 programmable fluorescence detector
Wavelength	Excitation: 229 nm Emission: 311 nm
Columns	Two Supelco C18 5μ (250 x 4.6 mm) in series
Mobile phase	13.0% methyl alcohol, 44.2% water, and 42.8% acetonitrile
Flow rate	1.0 mL/min isocratic, with a 12 min acetonitrile "flush" to remove low polarity materials from the columns between injections.
Column oven temperature	40°C
Injection volume	20 μL

Three-Piece Food Cans

A total of 10 types of steel three-piece cans/coatings was used. The can sizes were either 300 x 407 or 300 x 404, which may be considered "one-pound" cans. The coatings/cans typify their use with the following classes of packed foods: infant formula (liquid), vegetables, meat, fruit juice, and tomato products. Five of the samples were collected for the initial phase of the study. Four of these five were available for the second phase of the study; five additional samples were collected for the second phase. The cans were supplied by four individual can manufacturers using coating formulations supplied by five different suppliers.

Food-Simulating Liquids: FDA accepts the use of food-simulating liquids to determine the migration of components from polymers into foods because analyzing for trace levels of migrants in complex food matrices is technically challenging. In accordance with FDA's recommendations regarding food simulants, the food simulants used in the present study were 10% ethanol and 95% ethanol; 10% ethanol is an appropriate simulant for aqueous, acidic, and low alcohol content (up to 15% ethanol) foods, including beer, while 95% ethanol is an appropriate, albeit exaggerative, alternative fatty food simulant. The water was processed by deionization and distillation. The 10% ethanol was prepared by dilution of 95% ethanol (Quantum Chemical Corporation) with deionized, distilled water.

EXPERIMENTAL PROCEDURES

Testing was conducted under conditions that simulate or exaggerate the most severe conditions of actual use, which vary depending on the type of food packed in the cans.

Two-Piece Beverage/Beer Cans

Carbonated soft drinks, by far the predominant type of beverage packed in cans, are typically filled at room temperature and stored at or below room temperature. This corresponds to FDA's Condition of Use E*. Some of

*Room temperature filled and stored (no thermal treatment in the container).

the beer manufactured in the U.S. is pasteurized after it is filled into the can. This corresponds to FDA's Condition of Use D†. Therefore, the testing of the representative beverage cans (higher coating weight) was performed under the more severe of the two conditions, i.e., Condition of Use D (described in the following), so that the testing would serve as a simulation of beer use and, at the same time, an exaggeration of beverage use. All of these samples were tested using 10% ethanol as the food simulant.

Two-Piece Food Cans

The types of food packed in two-piece cans generally require retort sterilization, followed by room temperature storage. This corresponds to FDA's Condition of Use A**. Four of the samples were tested using 10% ethanol, while a fifth sample, used for meat products, was tested using 95% ethanol.

Three-Piece Food Cans

The thermal processing conditions for the foods packed in three-piece cans vary with each type of food:

Vegetables: retort (Condition of Use A);

Meat: retort (Condition of Use A);

Infant formula: retort (Condition of Use A);

Tomato products: retort (Condition of Use A);

Fruit juice: hot filled at temperatures as high as approximately 190°F, which corresponds to FDA's Condition of Use C††.

Eight of the samples were tested using 10% ethanol, while two (used for meat products) were tested using 95% ethanol.

In accordance with FDA's "Recommendations for Chemistry Data for Indirect Food Additive Petitions",[5] Condition of Use A testing was performed at 250°F for 2 hr followed by 120°F for 10 days, Condition of Use C testing was performed by filling the container with "hot" solvent, holding at 212°F for 30 min, followed by 120°F for 10 days, and Condition of Use D testing was performed by filling the container with solvent at 150°F, holding at 150°F for 30 min, followed by 120°F for 10 days.

Each exposure test was performed in duplicate. Duplicate solvent blanks were similarly extracted. The extracts obtained in the first phase were analyzed by high performance liquid chromatography (HPLC) direct injection, using the HPLC parameters in either *Tables* 1, 2, or 3 (see Discussion Section). The extracts obtained in the second phase were analyzed by HPLC using the parameters in *Table* 4 and by gas chromatography with mass selective detector (GC/MS) using the parameters in *Table* 5. The GC/MS is operated in the selective ion monitoring (SIM) mode and the method is based on the derivatization of the phenols to their silyl ethers using N,O-bis(trimethylsilyl)trifluoroacetamide (Pierce);

†Hot filled or pasteurized below 150°F.
**High temperature heat-sterilized (e.g., over 212°F).
††Hot filled or pasteurized above 150°F.

Table 3—Instrumental Conditions for High Performance Liquid Chromatography (HPLC) Analyses of Bisphenol A (Phase 1, Final Conditions)

Pump	Hewlett Packard 1050
Autosampler	Hewlett Packard 10
Detector	Hewlett Packard 1046 programmable fluorescence detector
Wavelength	Excitation: 229 nm Emission: 311 nm
Columns	Two Supelco C18 5µ (250 x 4.6 mm) in series
Mobile phase	14.3% methyl alcohol, 48.6% water, and 37.1% acetonitrile
Flow rate	0.8 mL/min isocratic, with a 12 min acetonitrile "flush" to remove low polarity materials from the columns between injections.
Column oven temperature	40°C
Injection volume:	20 µL

bisphenol F (bis(4-hydroxylphenyl)methane) is employed as an internal standard. A full description of the methods used in the second phase is discussed in the following article.[6]

For the analyses in both the first and second phases, quantitation was based on a standard curve generated by external BPA standards, prepared in either 10% ethanol or 95% ethanol, at concentrations of 5, 10, 20, 40, 80, and 160 ng/mL (parts per billion (ppb)). The detector response was measured by peak area. The method of analysis has a correlation coefficient of greater than 0.990 when a plot was generated of known standard concentrations versus detector response. The limit of detection (defined as not quantifiable) was set at 5 ppb.

For each food simulating liquid in the first phase of the study, validation of the results was performed by spiking the extract with BPA at either 5, 10, 20, 40, or 50 ppb prior to work up of the extract; the spiked extract was analyzed as described for each food simulant. The average of the recoveries was 101±19%.

Several of the extracts in the second phase of the study were likewise spiked with either 10 or 20 ppb BPA to validate both the HPLC and the GC/MS analyses. The average of the recoveries for HPLC was 86±1% and that for GC/MS was 110±0%. Further validation of the results was achieved by concomitant analyses of each of the second phase extracts by both HPLC and GC/MS.

RESULTS AND DISCUSSION

Migration Results

The study was conducted in two phases at different points in time. In the first phase, the 13 different can samples used in the study were selected to cover the major U.S. can manufacturers and their coating suppliers. The extracts obtained from these samples were analyzed using HPLC with a fluorescence detector. For the three beverage/beer can samples, BPA was not detectable (defined as not quantifiable below 5 ppb) in any of

Table 4—Instrumental Conditions for High Performance Liquid Chromatography (HPLC) Analyses of Bisphenol A (Phase 2)

Pump	Hewlett Packard 1050
Autosampler	Hewlett Packard 10
Detector	Hewlett Packard 1046 programmable fluorescence detector
Wavelength	Excitation: 229 nm Emission: 311 nm
Columns	Two Supelco C18 5μ (250 x 4.6 mm) in series, plus a Supelco LC-18 guard column
Mobile phase	43.0% acetonitrile (ACN) and 57.0% water
Flow rate	0.8 mL/min isocratic

Inter-injection gradient:

Time	Mobile Phase	Flow Rate
30 min	81.6/18.4 ACN/water	1.0 mL/min
35 min	0/100 ACN/water	1.0 mL/min
40 min	0/100 ACN/water	1.0 mL/min
45 min	100/0 ACN/water	1.2 mL/min
50 mim	100/0 ACN/water	1.0 mL/min

Column oven temperature: 40°C

the extracts. On the other hand, the two-piece and three-piece food cans gave results ranging from no detectable levels of BPA in the extracts (method sensitivity of 5 ppb) to 121 ppb; the two-piece food cans and three-piece food cans have been grouped together, since the results do not indicate a migration behavior that would distinguish one from the other.

In performing these analyses, the initial instrumental conditions, described in *Table* 1, were derived from the beverage container experiments. As the extraction experiments proceeded to the food cans, where the extraction conditions were more aggressive, a flush step was added to the instrumental conditions (described in *Table* 2) to remove materials trapped on the column which could interfere with subsequent determinations. A final set of instrumental conditions was developed (described in *Table* 3) when an interfering chromatographic peak was coeluting; the final set of instrumental conditions, which employed a lower acetonitrile content than the first two sets of conditions, resulted in extending the elution of BPA from approximately 11 min to approximately 17 min.

In reviewing these data, authors came to believe that some of the migration values reported, which ranged from none detected (using an analytical method having a limit of detection of 5 ppb) to 121 ppb, appeared to be higher than expected. This was based, in part, upon the unusual or unsymmetrical shape of the chromatographic signal attributed to BPA in several of the extracts, not all of which may have been due to the presence of bisphenol A. Upon consideration of the chromatograms, it was postulated that there may have been overlap between BPA and one or more substances exhibiting the same or similar retention time, i.e., analytical interferences may have been present that contribute to the BPA response.

For this reason, a series of round-robin tests was undertaken to generate methodology so that suitably equipped laboratories could confidently perform valid analyses of extracts for BPA. These efforts, a complete description of which is presented elsewhere in this issue,[6] resulted in the development of both HPLC and GC/MS methods.

Having obtained methodology to ensure, to the extent possible, that analytical interferences would be minimized, a second phase of the study was undertaken. The objectives were to repeat, and expand upon, the analyses obtained in the first phase on extracts of two-piece and three-piece food cans, i.e., those types of test samples that, as a group, showed detectable levels of BPA.

As noted previously, the first phase consisted of 13 different can samples selected to cover the major U.S. can manufacturers and their coating suppliers. Three of the 13 samples were two-piece beverage/beer cans, which showed no detectable BPA in the first phase, using methodology sensitive to 5 ppb. Because of the non-detected results in these samples, the second study focused entirely on the two-piece and three-piece food cans, i.e., the repeat study did not include beverage/beer cans. Of the 10 food can samples tested previously, nine were available for the current study. In addition to these samples, five additional samples, all three-piece cans, representing major types manufactured by the principal can manufacturers, were included in the second phase of the study.

The results from phases one and two are presented in *Table* 6. It should first be noted that the HPLC and GC/MS results in phase two give virtually identical results for any individual sample. These sets of comparable results validate the methodology employed in the second phase of the study. For this reason, the discussion following focuses on the averages of the HPLC and GC/MS results.

The two-piece and three-piece food cans that were duplicated from the first phase gave results ranging from no detectable levels of BPA in the extracts (method sensitivity of 5 ppb) to 77 ppb; as noted, the two-piece food cans and three-piece food cans have been grouped together since the results do not indicate a migration behavior that would distinguish one from the other. The five "new" cans gave results ranging from 12 ppb to 94 ppb. A review of the data indicates that five of the samples that were duplicated from the previous study showed essentially no change. Apparently, the use of the refined analytical methods demonstrated that chromatographic interferences were insignificant for these

Table 5—Instrumental Conditions for Gas Chromatography with Mass Selective Detector (GC/MS) Analyses of Bisphenol A (Phase 2)

Instrument	Hewlett Packard GCMS model 5970 Selective Ion Monitoring mode Masses 329 and 344 for internal standard (bisphenol F), and masses 357 and 372 for bisphenol A
Column	0.25 mm x 15 mm RTX-5
Oven temperature	250°C
Injector temperature	325°C
Transfer line temperature:	300°C
Injection mode:	Split, 50/1
Column head pressure:	2 psi

samples. However, the remaining four repeated samples showed substantial *reductions* in the measured BPA levels. It is important to recognize that these reductions are not a consequence of changes in the coatings or the manufacturing procedures for the cans. Instead, these results illustrate that several of the first phase results were artificially high because these particular coatings produced one or more interfering signals in the chromatographic analyses. In fact, the average of the duplicated food can samples dropped from 63 ppb (in the first phase) to 36 ppb.

The average of the "new" samples (i.e., second phase only) is 39 ppb, and the average of all samples is 37 ppb. This average value, as well as the results from the beverage and beer cans (not detectable at 5 ppb), have been used to derive an estimate of potential exposure to BPA from the use of epoxy-coated cans.

Table 6—Summary of Extraction Results

Can Sample	Simultant	Test Condition	BPA Level (ppb)[a] 1st Phase	2nd Phase HPLC	2nd Phase GC/MS
Two-piece beer/beverage cans:					
	10% ethanol	D	ND	—	—
	10% ethanol	D	ND	—	—
	10% ethanol	D	ND	—	—
Two-piece food cans:					
non-fatty food	10% ethanol	A	71	65	68
non-fatty food	10% ethanol	A	120	72	67
non-fatty food	10% ethanol	A	71	78	77
non-fatty food	10% ethanol	A	8	7	9
fatty food	95% ethanol	A	81	47	49
Three-piece food cans:					
infant formula	10% ethanol	A	121	7	8
vegetable	10% ethanol	A	40	—	—
meat	95% ethanol	A	ND	ND	6
fruit juice	10% ethanol	C	86	26	26
tomato product	10% ethanol	A	25	22	18
vegetable	10% ethanol	A	—	21	19
meat	95% ethanol	A	—	47	53
vegetable	10% ethanol	A	—	14	9
vegetable	10% ethanol	A	—	95	94
vegetable	10% ethanol	A	—	20	16

(a) ND = non-detectable (not quantifiable below limit detection, 5 ppb).

Estimate of Exposure

The evaluation of a component of a food packaging material depends on the postulated consumption of the substance (or any compound resulting from the use of the substance). Such consumption of the substance depends on the potential level in food (e.g., a value derived from migration studies) and on the fraction of an individuals diet likely to contact packaging materials containing the substance. As noted previously, FDA employs the term consumption factor (CF) to describe the portion of the diet likely to contact specific packaging materials, and has developed Food-Type Distribution Factors (f_T) for each packaging material or application to indicate the fraction of the food contacting each material that is aqueous, acidic, alcoholic, and fatty.

FDA uses CF and f_T values, along with estimates of the potential concentration of substances that may migrate from food packaging to the contacted food products, to estimate potential human exposure to the substances. The "average" concentration of the migrant in food contacting the packaging material, <M>, is derived by summing the products of the appropriate f_T values and the migration values relevant to the types of food, M_i. The concentration of the migrant in the diet is obtained by multiplying <M> by the appropriate CF:

$$\text{Dietary Concentration} = CF \times \langle M \rangle$$

$$= CF[f_{aq}M_{aq}+f_{ac}M_{ac}+f_{al}M_{al}+f_fM_f]$$

where the subscripts aq, ac, al, and f refer to aqueous, acidic, alcoholic, and fatty foods, respectively.

FDA's current CF for polymer-coated metal, which includes cans, is 0.17, and the corresponding aqueous, acidic, alcoholic, and fatty food f_T values are at 0.16, 0.35, 0.40, and 0.09, respectively.[5]

We have used these CF and f_T values, in conjunction with the migration results summarized earlier, to estimate the potential exposure to BPA. We have used the "worst case" assumption that the potential migration of BPA to acidic and alcoholic foods (i.e., beverages and beer, respectively) is 5 ppb (based on the non-detectable levels from the beverage/beer cans using the methodology which is sensitive to 5 ppb) and to all other food is 37 ppb, the average value expressed. Therefore, we have estimated the potential dietary exposure to BPA from use of epoxy can coatings to be:

$$\text{Dietary Concentration} = CF \times \langle M \rangle$$

$$= CF[f_{aq}M_{aq}+f_{ac}M_{ac}+f_{al}M_{al}+f_fM_f]$$

$$= 0.17[0.16(37\text{ ppb}) + 0.35(5\text{ ppb}) + 0.40(5\text{ ppb}) + 0.09(37\text{ ppb})]$$

$$= 0.17\ (13\text{ ppb})$$

$$= 2.2\text{ ppb}$$

CONCLUSIONS

Great care must be taken in analyzing extracts of can coatings for potential migrants, especially when using a non-specific analytical methodology such as liquid chromatography with fluorescence, ultraviolet, or other non-specific detection. As has been demonstrated by this

study, approximately one-half of the duplicated samples showed substantial *reductions* in the measured BPA levels. Furthermore, the fact that the other one-half of the can samples showed results virtually identical to those obtained in the first phase indicates that each coating is unique and its potential migration characteristics must be examined on a case-by-case basis. These results amply demonstrate that determined migration values may be artificially high unless the chromatograms are examined carefully so as to preclude the presence of interfering chromatographic signals. However, our observations are that artificially high results may be obtained even in instances where symmetrical peaks are obtained. For this reason, it is important to perform dual confirmatory analyses (e.g., HPLC as well as GC/MS) to eliminate the possibility of erroneously identifying an interference as BPA.

The study demonstrates that no detectable BPA is found in the extracts from beverage cans using a method sensitive to 5 ppb in the food simulant. The migration of BPA from food cans ranged from non-detectable (<5 ppb) to 94 ppb, with an average of 37 ppb. Using these data, along with information regarding the use patterns for food and beverage cans, the potential dietary exposure to BPA from use of epoxy can coatings was estimated to be approximately 2.2 ppb.

ACKNOWLEDGMENTS

The authors would like to express their thanks to the members of the Epoxy Can Coating Work Group of the Inter-Industry Group on Bisphenol A and Alkylphenol for their technical assistance in the preparation of this manuscript.

References

(1) Title 21 Code of Federal Regulations (C.F.R.) § 175.300.
(2) Directive 90/128/EEC. Bisphenol A is cleared by several European countries that maintain "positive lists" of permissible components of food-contact articles. For example, it is permitted for use in food-contact materials in Germany, Spain, Italy, Belgium, and the Netherlands. In addition, BPA has been included on the European Union's (EU) so-called "Monomers Directive" (Directive 90/128/EEC) for use as a monomer in food-contact plastics.
(3) Brauer. B. and Funke, T. "Determination of Phenols in Aqueous Food Solutions," *Deutsch. Lebensm.-Rundsch., 88*, 243-6, 1992.
(4) Brotons, J.A., Olea-Serrano, M.F., Villalobos, M., Pedraza, V., and Olea, N., "Xenoestrogens released from Lacquer Coatings in Food Cans," *Environmental Health Perspectives, 103*, 608-612, 1995.
(5) Food and Drug Administration, June 1995, "Recommendations for Chemistry Data for Indirect Food Additive Petitions."
(6) Wingender, R.J., Niketas, P., and Switala, C.K., "Development of Methods for the Determination of Bisphenol A in Food Simulants," JOURNAL OF COATINGS TECHNOLOGY, *70*, No. 877, 75 (1998).

Development of Methods for the Determination of Bisphenol A in Food Simulants

R.J. Wingender* and Paul Niketas—Dexter Packaging Products, Div. of Dexter Corp.**
Christopher K. Switala—The Valspar Corp.†

INTRODUCTION

Epoxy resins based on bisphenol A (BPA) (4,4'-isopropylidenediphenol or 2,2-bis[4-hydroxyphenyl] propane) are cleared by the United States Food and Drug Administration (FDA), throughout Europe, and the Pacific Rim. Although methods of analysis for BPA have been published, including analyses associated with coatings, these are not validated methods with the performance characteristics necessary for successful analyses in regulatory food simulants, nor have they been developed with this intended use in mind.[1-8]

The present study was conducted to develop analytical methodology so that analyses of food-simulating extracts of can coatings for BPA could be performed with confidence by suitably equipped laboratories. The food simulants are those recommended for this purpose by FDA.[9] In addition, the study to develop suitable methodology was undertaken to ensure to the extent possible, that analytical interferences would be minimized.

Specifically, the methodology development was begun following an initial study to collect migration data from extractions of unused commercial cans using FDA's customary procedures.[9] In reviewing the data from this initial study, the researchers came to believe that the apparent migration values observed seemed to be unrealistically high. This speculation was based, in part, on the unusual or unsymmetrical shape of the chromatographic signal obtained from an HPLC separation with fluorescence detection for several of the extracts. This would indicate that not all of the measured signals may have been attributable to BPA. After a review of the chromatograms, it was postulated that there may have been overlap between BPA and one or more substances exhibiting that same or similar retention time, i.e., there may have been analytical interferences present that contributed to the BPA response. A complete description of the initial study, as well as a final study using the methodology described in the current paper is presented in the previous paper.[10]

Epoxy resins based on bisphenol A (BPA) have been used as components of food and beverage can coatings for more than 50 years. The recent interest in analysis of extractable BPA from these resins has made it necessary to develop validated methods with performance characteristics necessary for successful analyses in regulatory food simulants. The present study was conducted to develop analytical methodology so that suitably equipped laboratories could confidently perform these analyses. Two methods were developed and validated through round-robin sampling. A historical treatment of the method development challenges, round-robin studies, and results are described here.

The first attempt to determine the possibility of analytical interferences involved splitting some of the coating extracts obtained in the initial study for analysis by another technique.

A capillary column GC/MS analysis using selected ion monitoring was chosen as an alternate approach that could confirm the values reported from the HPLC analysis. While this technique provided adequate selectivity, the polarity of the underivatized BPA introduced other difficulties.

To address these issues, an analytical work group was established to optimize and validate methodology for the analysis of BPA in food simulants. The work group was made up of members from the major coatings manufacturers (see acknowledgement). The mission of this group was to develop a standard method to analyze the level of BPA migration from epoxy can coatings into appropriate food simulating solvents and to correlate

*Author to whom correspondence should be addressed.
**1 East Water St., Waukegan, IL 60085, USA.
†Present address, Matco Associates, Inc., 4640 Campbells Run Rd., Pittsburgh, PA 15205. Contact Lee S. Malone, Valspar Corp., 2000 Westhall St., Pittsburgh, PA 15233.

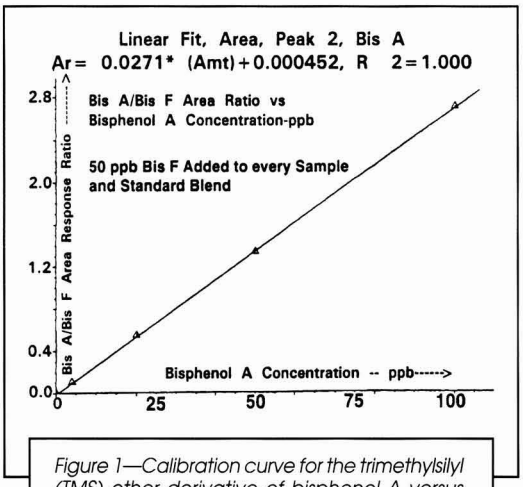


Figure 1—Calibration curve for the trimethylsilyl (TMS) ether derivative of bisphenol A versus the ratio of the response (peak area) of bisphenol A (TMS) to the response of the internal standard, bisphenol F (TMS).

results from two alternate approaches. The two most suitable techniques were identified as HPLC and GC/MS.

Method development improvements were accomplished through submission of split and/or round-robin samples to participants and subsequent discussion of optimization approaches. For the round-robin trials, the beer and beverage container coatings were dropped from further consideration since the BPA levels were found to be below the five parts per billion (ppb) limit of quantitation in the cans tested.

For the first round-robin trial, a food can coating extract that resulted in a complex chromatogram in the initial study was selected for further analysis. Participants were asked to use their best available methodology to determine the BPA concentration. The values reported indicated further round-robin trials were needed to improve the methodologies and achieve acceptable accuracy and reproducibility in the presence of the coextracted materials. In all, three round-robin sample sets were submitted. One can coating which proved to contribute the most difficult matrix was included in all studies.

Table 1—Concentration of Bisphenol A in ppb from Analysis of the First Round-Robin Sample by Participating Labs

ppb BPA for Coating Number 5	
Lab#/Method	**ppb Bisphenol A**
1 $HPLC_{UV}$	69
2 HPLC	92
GC/MS_{nd}	98
3 GC/MS_{nd}	75
4 GC/MS	65
5 HPLC	71
6 HPLC	102
7 HPLC	106
8 HPLC	71
Avg ppb	83
σ_{n-1}	16
%RSD	19

UV: Used UV rather than fluorescence detector.
nd: No derivatization of bisphenol A.

The HPLC approach required two columns in series and an adjustment in the eluting phase to accomplish the necessary separation of BPA from the coextracted material. The GC/MS approach, on the other hand, was changed considerably to include a derivatization of the BPA with a silylating reagent forming the trimethylsilyl (TMS) ether derivative to optimize the chromatography. This step enhanced peak shape and resolution from interferring components whereas operation in the selected ion monitoring (SIM) mode removed all contributions from the coextracted materials. An internal standard, the 4,4'-isomer of bisphenol F (bis(4-hydroxyphenyl)methane) was added to improve precision. Following successful development of the methods, the original study was repeated,[10] this time using both optimized methods which are reported here.

EXPERIMENTAL

Can Processing

All filling of cans with food simulant, end sealing, processing, and sample submission to participating labs was conducted by the National Food Processors Association (NFPA). The food simulant selected for the three round-robin studies was 10% ethanol in water, and the processing conditions were two hours at 250°F. Both two-piece and three-piece cans were used in the round-robin study. The identities of the selected can coatings were unknown to the participants, including the NFPA. The filling and processing procedures have already been published.[10]

Because all can samples were processed at one time in one autoclave, it was assumed for the purposes of this study that each participating lab would receive identical samples. In reality, differences due to coating applications, time/temperature cure exposure in the ovens, and to exposure differences during processing are to be expected. Therefore, the data reported by each participating lab will include variation from all these sources as well as random experimental variation inherent in every test procedure.

Final HPLC Method

Valspar HPLC/Fluorescence Method: The HPLC analysis was performed with a Perkin-Elmer Series 200 LC pump, ISS 200 autosampler, LC oven 101 column oven, and LC 240 fluorescence detector. Two Supelcosil LC-18, 250 mm × 4.6 mm columns (Supelco, Cat. # 5-8298) analytical columns are connected in series. A Supelguard LC-18, 20 mm × 4.6 mm guard column (Supelco, Cat. # 5-9554) is used to protect the analytical columns.

The column oven temperature is set at 40°C, the detector attenuation factor at 128, and the response level value at 3 (equivalent RC, 98% FS, response time, 1.4s).

The detector excitation wavelength used is 275 nm, and the emission wavelength is 300 nm. The photomultiplier voltage of the detector is 750V.

Bisphenol A was obtained from Aristech. Ethyl alcohol (200 proof) was purchased from Quantum Chemical.

Water and acetonitrile (HPLC grade, Fisher Scientific, Cat. # A998-4) degassed with helium are used as HPLC mobile phases.

The HPLC conditions are:

HPLC Sequence	Time, min	% Acetonitrile/ Water	Flow mL/min
Start	0	Initial: 43/57	1
Linear gradient	30	to Final: 53.5/46.5	1
Linear gradient	5	to 100/0	1
Column wash	5	at 100/0	1.2
Return to start			

Under these conditions, BPA elutes at approximately 16 min.

Calibration is performed using BPA standards in 10% ethanol/water. Bisphenol A standards at 10, 50, and 100 ppb (w/w) in 10% ethanol water are prepared from a 1 ppm (w/w) stock solution of BPA in ethyl alcohol. Sample injection volume is 50 mL. An external standard three-point calibration, with a first order curve fit, is used.

Prior to injection, all samples and standards are filtered through a 0.5 mm Millex LCR_{13} modified hydrophilic polytetrafluoroethylene (PTFE) membrane filter (Millipore, Cat. # SLCR-013-NS). Centrifugation for 30 min at 12,000 rpm was found to be a suitable alternative to filtration. New lots of filters are tested to ensure there is no loss of BPA as a result of filtration. The testing protocol involves a peak area comparison of filtered standards versus unfiltered and centrifuged standards.

Final GC/MS Method

Dexter Derivatization/GC/MS Method: A model 5890 Hewlett-Packard GC interfaced with a model 5970 mass selective detector (MSD) is used. The GC is equipped with a capillary column.

Bisphenol A (Cat. No. 13,302-7) and bisphenol F, the internal standard (ISTD) (Cat. No. B4,700-6), are obtained from Aldrich.

{Note: Bisphenol F cannot be used in the analysis of coatings that contain bisphenol F-based epoxy novolacs. In those cases, a variety of suitable internal standards that are hydroxyl-bearing fused ring aromatics can be considered as alternates.}

A stock solution of BPA (solution A) is prepared containing 0.1 g/L or 100 ng/mL of BPA, weighed to the nearest 0.1 mg, in tetrahydrofuran (THF, BHT-stabilized, Burdick and Jackson, Cat. No. 340-1). A stock solution of bisphenol F is prepared containing 0.025 g/L or 25 ng/mL of bisphenol F in THF.

For analysis of 50 mL samples, standard solutions are prepared in 20 cc vials using 100 µL and 10 µL syringes:

100 ppb Std. — use 50 µL of solution A
50 ppb Std. — use 25 µL of solution A

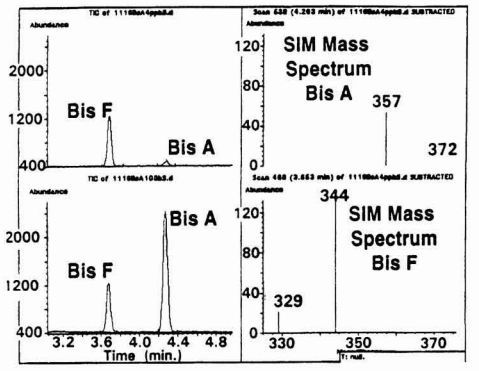


Figure 2—Selected ion monitoring (SIM) chromatograms of bisphenol A standards at a 4 ppb and at 100 ppb showing the internal standard (ISTD) bispenol F , and the SIM mass spectrum of both the TMS derivatized bisphenol A and TMS derivatized bisphenol F.

20 ppb Std. — use 10 µL of solution A
4 ppb Std. — use 2 µL of solution A

followed by 100 µL of the bisphenol F solution, and the vial is capped with Teflon faced septa Teflon seal No. 62121D-20, from Kimble, Baxter.

From each sample extract, 50 mL aliquots are withdrawn and dispensed into 125 mL vials. To each sample solution, 100 µL of the bisphenol F solution are added prior to concentration.

All standard and sample blends are concentrated at room temperature under a vigorous stream of nitrogen (a hot water or steam bath can be used to speed up the process). After drying, about 2 mL of methanol are added to all the 125 mL vials and the contents are transferred to

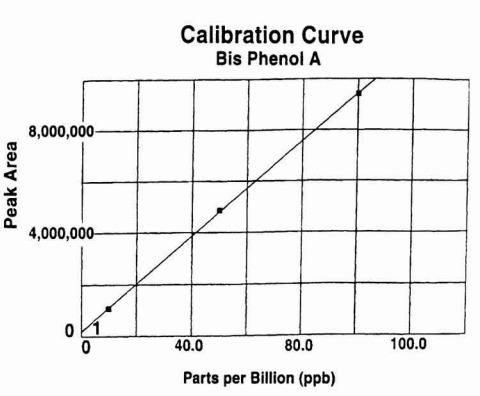


Figure 3—Calibration curve for bisphenol A obtained by HPLC with fluorescence detection, ppb versus peak area.

Table 2—Concentration of Bisphenol A in ppb from Analysis of the Second Round-Robin Sample Set by Participating Labs

	ppb Bisphenol A for Coating Number					
Lab#/ Method	#1	#2	#3	#4	#5	#6
2 HPLC	23	8	6	17	64	14
3 GC/MS_{nd}	29	12	16	22	52	21
4 GC/MS	32	8	8	21	71	21
5 HPLC	35	6	8	7	80	9
6 HPLC	22	9	17	41	91	5
7 HPLC	30	10	6	24	75	18
8 HPLC	10	8	8	16	67	16
Avg ppb	26	8.7	9.8	21	71	15
s_{n-1}	8.4	1.9	4.6	10	12	6.0
%RSD	32	22	47	49	17	41

nd: No derivatization of bisphenol A.

20 cc vials. The standards and samples are dried under nitrogen once again.

Silylation with TMCS

One mL of trimethylchlorosilane (TMCS, Pierce, Cat. No. 88531) is added to each vial which is then capped and placed in an oven at 100°C. The reaction is complete within 30 min. The vials are then cooled to room temperature for injection into the GC/MS.

Silylation with BSTFA

One ml of N,O-Bis(trimethylsilyl)trifluoracetamide (BSTFA) containing one percent TMCS (Supelco Cat. No. 3-3149) is added to each vial which is capped and held at room temperature. The reaction is complete in 60 min. (The ratio of derivatized BPA to bisphenol F species decreases as a function of time up to 60 min due to different reaction kinetics.)

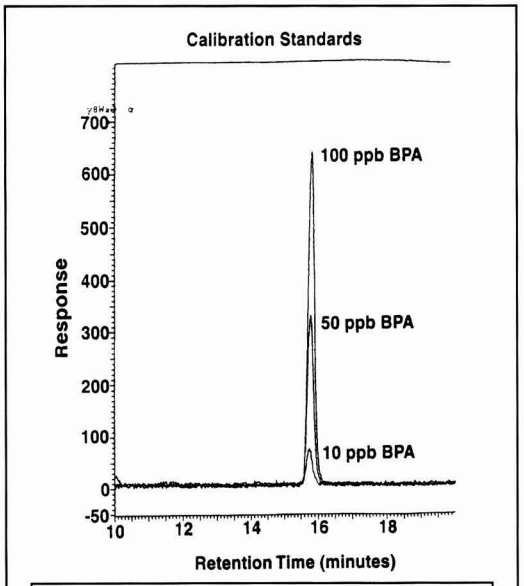


Figure 4—HPLC chromatogram showing the fluorescence detector response of standard injections at 10 ppb, 50 ppb, and 100 ppb bisphenol A.

Analysis

The gas chromatographic conditions are:

Column: 0.25 mm x 15 m, RTX-5 Amine 1μ loading from Restek
Carrier: Helium @ 2 psi column head pressure
Oven: 250°C isothermal
Injector and transfer line temperature: 325°C & 300°C
Injection: 2 mL split 50/1

The MSD is run in the SIM mode to monitor the 329 and 344 masses for the silyl ether of bisphenol F (internal standard) and 357 and 372 masses for the silyl ether of BPA. Satisfactory chromatography was also obtained using a 0. m x 15 m DB-1 column 1 m loading from J&W.

Under these conditions the bisphenol F silyl ether elutes at 3.7 min and the BPA silyl ether elutes at 4.3 min.

For each standard chromatogram the BPA-to-bisphenol F area ratio is computed and plotted against the BPA concentration in ppb. The plot is linear as shown on *Figure* 1. The slope of the plot is the area ratio of BPA-to-bisphenol F per ppb in the standard solutions. From the sample chromatograms, the BPA-to-bisphenol F area ratio is computed. To find the concentration of BPA in the sample, this ratio is divided by the value for the slope from the plot on *Figure* 1.

RESULTS AND DISCUSSION

The selection between HPLC or GC/MS techniques by the round-robin participants depended on the availability of the instrumentation. Some participants preferred to use both. The HPLC method used in the initial study[10] demonstrated satisfactory separation between coextracted materials and BPA in some instances, but not in others. As a result, the method underwent further improvements throughout the round-robin studies by

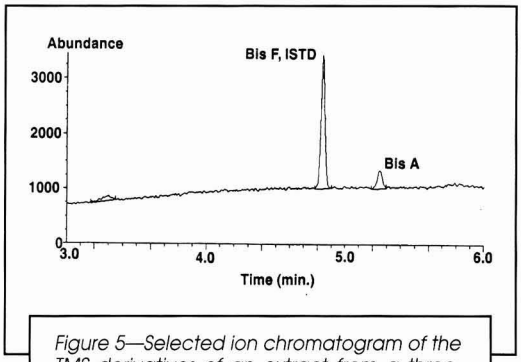


Figure 5—Selected ion chromatogram of the TMS derivatives of an extract from a three-piece coated can with a vinyl sideseam stripe having an experimentally determined value of 12 ppb bisphenol A.

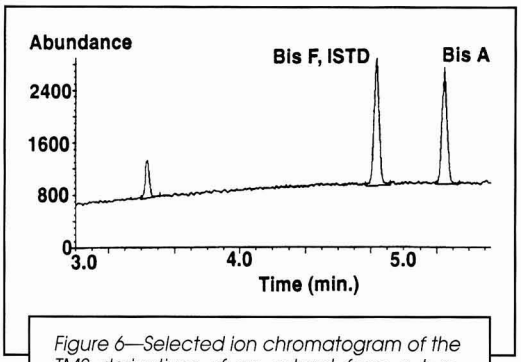


Figure 6—Selected ion chromatogram of the TMS derivatives of an extract from a two-piece coated can having an experimentally determined value of 64 ppb bisphenol A.

Valspar personnel to ensure that these materials did not coelute with the BPA and lead to values biased on the high side.

Similarly, the GC/MS method used initially appeared reasonably successful because of the agreement of the values with those from the HPLC approach. This method involved chromatographing the free BPA in aliquots of the extract.

Round-Robin No. 1

Data from the first round-robin study are presented in *Table* 1. Most labs used the HPLC technique, and one lab used GC/MS and direct injection of the sample without derivatization. Rather than the expected monomodal distribution of values, a bimodal distribution was obtained with nodes at about 70 and at 100 ppb BPA. The overall average value was 83 ppb, and the relative standard deviation (%RSD) was 19%. Further method optimization was considered and a second round-robin study was discussed.

Of foremost concern with the GC/MS method was the poor chromatography of BPA which tended to cause unsymmetric peaks (tailing) due to its polarity, and unpredictable reproducibility of repeat analyses. It was found that the presence of coextracted materials coinjected into the hot injection port caused "ghosting" which led to the unpredictable data.

Both problems were eliminated by producing the trimethylsilyl derivative of BPA which led to excellent chromatography with no ghosting. In addition, the reproducibility was further enhanced by use of bisphenol F as an internal/surrogate standard. It was selected because it is carried through the analysis steps with BPA due to its structural similarity.

In addition, after drying an aliquot of each extract, it was necessary to use methanol to selectively dissolve the residue. This step removed the possibility of interferences from other materials (such as metallic salts) that affected the silylation step. Both BPA and bisphenol F were quantitatively extracted into the methanol.

The resulting changes led to the GC/MS method presented in the Experimental Section. Using these conditions, a calibration plot of response versus ppb BPA was prepared to demonstrate linearity (see *Figure* 1). A chromatogram showing abundance versus retention time for two concentrations of BPA with the internal standard present is given in *Figure* 2.

Before the second round-robin study was started, the possibility of interference from the presence of one or more components from a vinyl sideseam stripe in the BPA quantitation by the HPLC approach was discussed. As a result, Valspar personnel changed the HPLC conditions to effect baseline resolution between the potential coelutant and analyte. This was not an issue with the GC/MS approach.

Round-Robin No. 2

This potential source of interference led to inclusion of three-piece cans both with and without a vinyl

Table 3—Concentration of Bisphenol A in ppb from Analysis of the Third Round-Robin Sample Set by Participating Labs

Lab# / Method	Average ppb Bisphenol A		
	Coating #1	Coating #2	Coating #3
2 HPLC	9	18	65
GC/MS	11	19	71
3 HPLC	8.1	12.2	76
4 GC/MS	11	19	66
5 HPLC	4.3	11.6	63.4
6 HPLC	7	14	62
GC/MS	9	19	70
7 GC/MS	8.1	19.3	80.8
8 HPLC	8	17	66
Avg_x	8.4	16.6	68.9
s_x	2.04	3.12	6.20
%RSD	24	19	9.0

Avg_x = Average of cell averages; s_x = standard deviation of cell averages.

Table 4—Concentration of Bisphenol A in ppb from Analysis of the Third Round-Robin Sample Set by Participating Labs Showing the Average Values and Statistical Evaluations Obtained for Each of the Two Methods

Coating Method: Lab #	Average ppb Bisphenol A for Coating Number					
	#1 HPLC	#2 HPLC	#5 HPLC	#1 GC/MS	#2 GC/MS	#5 GS/MS
2	**9** n=2 s=1.41	**18** n=2 s=0	**65** n=2 s=2.82	**11** n=2 s=3.61	**19** n=2 s=3.61	**71** n=2 s=1.41
3	**8.1** n=2 s=0.42	**12.2** n=2 s=0.14	**76** n=2 s=2.26			
4				**11** n=3 s=1.08	**19** n=3 s=1.78	**66** n=3 s=6.31
5	**4.3** n=2 s=0	**11.6** n=2 s=0.42	**63.4** n=2 s=2.47			
6	**7** n=3 s=1.0	**14** n=3 s=2.08	**62** n=3 s=3.05	**9** n=3 s=1.73	**19** n=3 s=2.64	**70** n=3 s=.58
7				**8.1** n=3 s=0.40	**19.3** n=3 s=1.15	**80.8** n=3 s=5.63
8	**8** n=2 s=1.41	**17** n=2 s=1.0	**66** n=2 s=2.6			
Avg. s_{avg} %RSD	**7.28** 1.81 25	**14.6** 2.85 20	**66.4** 5.54 8.3	**9.78** 1.46 15	**19.1** 0.15 0.79	**72** 6.28 8.7

n = Number of determinations; s = cell standard deviation; s_{avg} = sample standard deviation of average values.

sideseam stripe in the second round-robin to test whether the participants could successfully use the method change. In all, six cans were supplied. The data resulting from the revised methodology are given in *Table* 2. While a statistical evaluation of these data indicated that improvement in the reproducibility of the methods was needed, it must be pointed out that samples numbered 2 and 3, and numbered 1 and 4 were pairs differing between each other only in that one in each pair had a vinyl sideseam stripe. The agreement between these pairs of values indicates that the HPLC methodology has now been successful in eliminating any contribution from coeluting vinyl stripe components.

The variation in the HPLC data was subsequently found to result from the sample prefiltration step used in the analysis. Each round-robin participant utilized a different sample prefiltration procedure, or used none at all. At the same time, it was discovered that the nylon membrane syringe filter specified by the Valspar HPLC method could cause a loss of the BPA during filtration. This prompted further work to identify a reproducible sample prefiltration procedure which causes no loss of the analyte.

In this investigation, syringe filters having hydrophilic polypropylene, nylon, and hydrophilic PTFE were evaluated. Bisphenol A losses of greater than 30% were found for analyses performed with syringe filters having hydrophilic polypropylene and nylon filter media. There was no reported loss of BPA when sample extracts were centrifuged, or filtered through a syringe filter having a hydrophilic PTFE filter media. As a result, the filter type specified in the method was changed, and the option to centrifuge the sample extract prior to injection was included.

The resulting changes led to the HPLC method presented in the Experimental Section. Using these conditions, a calibration plot of peak area versus ppb BPA was prepared to demonstrate linearity (see *Figure* 3). A chromatogram showing detector response versus retention time for the three concentrations is given in *Figure* 4.

Round-Robin No. 3

At this point a third round-robin sample set was identified to test these findings and to improve the reproducibility of the data. For this set, three coatings were selected. Examples of chromotograms from two sample extracts are given in *Figures* 5 and 6 for the GC/MS approach, and in *Figures* 7 and 8 for the HPLC approach. The resulting data are presented in *Table* 3. Comparison of the relative standard deviation values indicates that good progress had been made in improving the precision of the data.

Primary focus had been placed on coating number 5 throughout these tests because it produced the most difficult matrix to analyze. It was therefore included in all three round-robin sets. The close agreement in the reported values in *Table* 3 for this coating indicates that

the methods were able to effectively deal with the complex matrix.

In general, the precision of the data is good when considering that the values include can-to-can variation, experimental variation, and utilization of two different methods. The relative standard deviation for all values appears large only because the values themselves are very small. Upon comparing the standard deviation values from the three round-robin sets, it is clear that the methodology had been significantly improved by the third set.

The original purpose of these round-robin sets was to develop two methods that would ensure that the BPA could be chromatographically separated from coextracted species for interference-free quantitation. The HPLC method was developed as a working method whereas the GC/MS method was designed as the reference method. All participants indicated that interference-free quantitation and satisfactory repeatability were achieved with the third round-robin set using one or both methods and the charge of the task group was therefore accomplished.

The data as presented in *Table* 4 provide a comparison of the precision of the data obtained by the two methods. The GC/MS method, in general, appears to be slightly more precise than the HPLC method. This is probably due to the use of an internal standard in the GC/MS method.

To be of practical value, standard procedures are required for determining the accuracy of a test method, both in terms of its bias and in terms of its precision. To obtain reasonable estimates of repeatability and reproducibility (R&R) precision, it is necessary to plan the interlab study toward achieving that goal. Although this study was not planned with an R&R evaluation in mind, the third round-robin set comes the closest to providing interlab R&R information.

The evaluations were made using the data from set 3 following ASTM computations.[11] For these computations, the data from both HPLC and GC/MS methods given in *Table* 3 were combined, (the average value reported by each participant for each method was used, but the value for the number of test results per cell was assumed to be 2 in all cases). The results from these calculations provide a measure of the degree of agreement among the test results and are given in *Table* 5.

This type of computation provides an estimate of the overall precision of the two methods. Repeatability con-

Table 5—Results of Statistical Evaluations using ASTM Method E 691

Calculated Statistical Parameter	Coating Number #1	#2	#5
Avg_x (from *Table* 3)	8.39	16.57	68.91
s_x (from *Table* 3)	2.04	3.12	6.20
s_r = repeatability std dev = $\sqrt{\Sigma s^2/\rho}$	1.58	1.83	3.48
s_R = reproducibility std dev = $\sqrt{(S_x)^2 + (S_r)^2(n-1)/n}$	2.33	3.38	6.67

ρ = Number of laboratories; s = cell standard deviation (from *Table* 4).

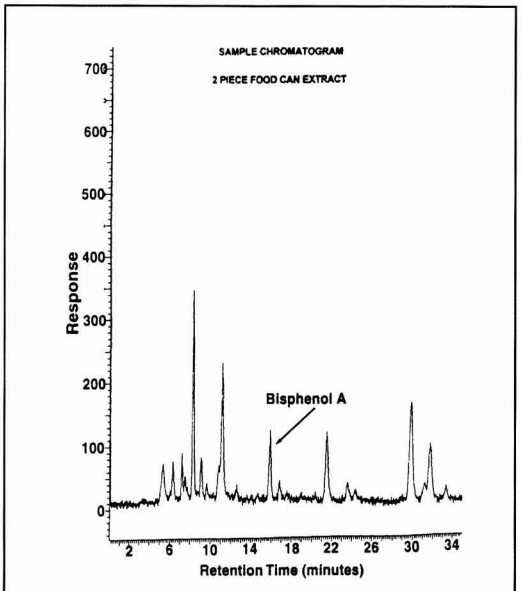


Figure 7—HPLC chromatogram of a sample extract from a two-piece can.

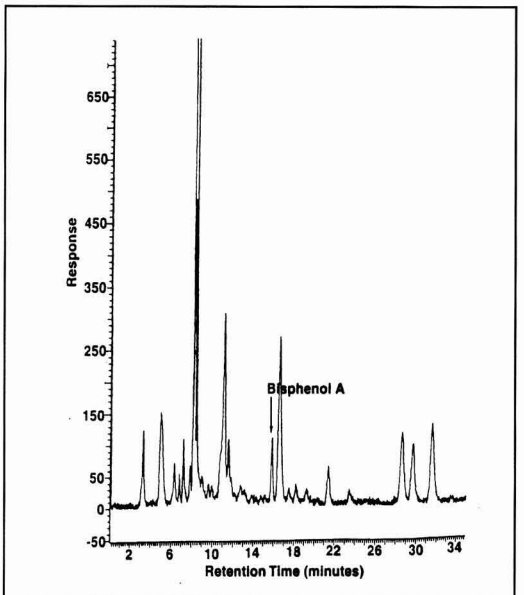


Figure 8—HPLC chromatogram of a sample extract from a three-piece can.

cerns the variability between independent test results obtained within a single lab whereas reproducibility deals with the variability between single test results (from both methods in this case) obtained in different labs. The statistical evaluation provides an indication of the interlab variation in the results. The computed uncertainty describes an encouraging confidence about the true value of extracted BPA for the coatings using the given methodology.

ACKNOWLEDGEMENT

The HPLC and GC/MS methods were developed by Christopher Switala and Paul Niketas, respectively. R. Wingender was Chair of the Epoxy Resin Can Coating Analytical Work Group for the Inter-Industry Group on Bisphenol A and Alkyl Phenols that was commissioned with the method development challenge. The group participants and their company affiliation included William Worley, BASF; Fred Mauck, Benjamin Moore & Technical Coatings; R. Wingender, Dexter; Dan Brennan, ICI Glidden; Roy Lyon, NFPA; Joe Benga, PPG; and Christopher Switala, Valspar. The Association of Plastics Manufacturers in Europe (APME) also participated in some of the round-robin analyses. Susan Howe, SPI and Lester Borodinsky, Keller & Heckman helped code the cans and review the data from each study. The authors would also like to thank Lester Borodinsky for his review of the manuscript and helpful comments, and Dexter Packaging Products Division of the Dexter Corp. and The Valspar Corp. for permission to publish this work.

References

(1) Peltonon, K., Pffäffli, P., Itkonen, A., and Kalliokoski, P., "Determination of the Presence of Bisphenol A and the Absence of Diglycidyl Ether of Bisphenol A in the Thermal Degradation Product of Epoxy Paint Powder," *Am. Ind. Hyg. Assoc. J.*, 47, 399-403 (1986).

(2) Larroque, M., Brun, S., and Blaise, A., "Migration of Constitutive Monomers from Epoxy Resins used as Coating Material for Wine Vats," *Sci. Aliments*, 9, 517-31 (1989).

(3) Brauer, B. and Funke, T., "Determination of Phenols in Aqueous Food solutions," *Deutsch. Lebensm.-Rundsch.*, 88, 243-6 (1992).

(4) Gandara, Simal, J., Paz Abuin, S., Paseiro Losada, P., and Simal Lozano, J., "Determination of Bisphenols A and F in Noncured Epoxy Resins by Rp-HPLC-Fluorescence Techniques," *J. Chromatographic Science*, 31, 450-4 (1993).

(5) Philo, M.R., Jickells, S.M., Damant, A.P., and Castle, L., "Stability of Plastics Monomers in Food-Simulating Liquids under European Union Migration Test Conditions," *J. Agric. Food Chem.*, 42, 1497-501 (1994).

(6) Wagner, S., Jakob, L., Rapp, A., and Niebergall, H., "Investigations on the Migration from Tanks Manufactured of Glass Fiber-Reinforced Polymer into Wine," *Deutsch. Lebensm.-Rundsch.*, 90, 218-22 (1994).

(7) Brauer, B. and Funke, T., "Detection and Determination of Phenols in Aqueous Migration Solutions from Plastic Utensils. A modification," *Deutsch. Lebensm.-Rundsch.*, 91, 146-7 (1995).

(8) Brotons, J.A., Olea-Serrano, M.F., Villalobas, M., Pedraza, V., and Olea, N., "Xenoestrogens Released from Lacquer Coatings in Food Cans, "*Environmental Health Perspectives*, 1995, 103, 608-612.

(9) Food and Drug Administration, "Recommendations for Chemistry Data for Indirect Food Additive Petitions," June 1995.

(10) Borodinsky, L., Howe, S.R., and Lyon, R.S., "*Potential Exposure to Bisphenol A from Food-Contact use of Epoxy Coated Cans*," JOURNAL OF COATINGS TECHNOLOGY, 70, No. 877, 69 (1998).

(11) ASTM Method E 691 - 87 Section 14, Volume 14.02, p 430, 1990.

Study of the Attack of Acidic Solutions on Melamine-Acrylic Basecoat/Clearcoat Paint Systems

W.R. Rodgers, D.P. Garner, G.D. Cheever—General Motors Corp.*

The extent of penetration of an acidic solution into a melamine-acrylic coating, the bulk changes in the thermal properties of the coating, and the chemistry and kinetics of acid degradation were investigated. Fluorescent microscopy experiments showed that significant penetration of the clearcoat occurs rapidly with acidic solutions. Thermal analysis of a matrix of samples exposed to a variety of conditions showed that significant differences occurred as a function of time, temperature, and acid concentration. Infrared analysis showed unreacted excess alkoxy-methyl melamine was hydrolyzed first, followed by the hydrolysis of the crosslinks.

Acidic solutions are able to penetrate the coating in a short time. Once in the coating, chemical reactions occur which result in degradation of the crosslinked network causing a change in the thermal properties and the appearance of the coating materials. The reaction is hydrolysis of the crosslinks followed by either destruction or leaching of the crosslinking material.

INTRODUCTION

Acid rain is formed when specific pollutants combine with water in the atmosphere. By far the largest contributor to this problem is sulfur dioxide (SO_2), a by-product of fossil fuel combustion which, when oxidized to H_2SO_4, accounts for 62-77% of the acidity in rain.[1] Most of the remaining acid is from nitrogen oxides (NO_x), found mainly in automobile exhaust, which are oxidized to HNO_3 (15-32%).[1] In addition to these two main species, HCl (2-16%), also produced from the burning of coal, is found in the atmosphere.[2]

A complicating factor in the study of the effects of acid rain on automotive paints is that the severity of the exposure varies with the location (the northeast section of the United States has more acid rain than the southwest), the time of year (i.e., roughly 70% of the reported incidents occur in summer), the acid concentration of the precipitation (pHs of 2 to 5 are known), and the form of the deposition (rain, snow, fog, or dew).[3] In addition, particulates impregnated with acids or which themselves are inherently acidic are also common industrial atmospheric pollutants, and when combined with water, may be a major source of damage to automotive topcoats.[4] A sampling of acid rain compositions at different locations and times is shown in *Table* 1.

Field studies of spotting were carried out during the last four years. These studies began with exposing vehicle hoods to outdoor conditions for several weeks and then visually rating the appearance as a measure of the extent of spotting damage.[5] Recently, these experiments have included the monitoring of atmospheric conditions as well as the exposed materials. These studies showed that crystalline materials, predominantly calcium sulfate ($CaSO_4$), were present in the spot. After washing the area, the crystalline materials were removed, but the clearcoat was shown to be scarred. In addition, the extent of spotting was found to be inversely proportional to the volume of the rain event.

However, regardless of the form of the deposition, it is important for us to recognize that it does occur and to find a means of preventing the resulting damage. This report focuses on the characterization of chemical damage to melamine-acrylic basecoat/clearcoat enamel (BC/CC) paint systems by sulfuric acid, "acid rain" and sodium sulfate. A comparison between the behavior of the BC/CC and the 27% non-aqueous dispersion systems is presented. Also, the effect of the concentration of the acid solutions and the effects of time and temperature were evaluated using fluorescent microscopy, differen-

*Polymers Department, Research & Development Center, 30500 Mound Rd., Box 9055, Warren, MI 48090-9055.

Table 1—Relative Compositions of Acid Rain (Equivalent %)

Reference	H_2SO_4	HNO_3	HCl
Pierson, W.R.[1]	77.2	20.4	2.4
Lampe, K.[4]	69.1	15.1	15.8
Cadle, S.H.[12]	62.0	32.0	6.0
Dasch, J.M.[13]			
Rain	68.0	32.0	—
Snow	61.0	39.0	—
This work	65.5	20.7	13.8
	70.0	25.0	5.0

tial scanning calorimetry, and reflectance infrared spectroscopy.

EXPERIMENTAL

Panel Preparation

The materials used in this study are listed in *Table* 2. The painted samples were all prepared on electrodeposition primed (ELPO coated) cold-rolled steel.

For these experiments the basecoats were dark garnet red metallic and black, and the clearcoat was a high-solids rigid clearcoat. Both the basecoat and the clearcoat were enamels crosslinked with a partially alkylated melamine with appropriate acid catalyst. These samples were applied wet-on-wet with five minutes flash between the basecoat and the clearcoat. The application of the coatings was carried out using a DeVilbiss JGA-502 spray gun with an EX fluid tip for the basecoat and an FF fluid tip for the clearcoat. The panels were flashed at room temperature for 5 min and then cured for 30 min at 121°C in a forced air circulation oven.

CHEMICAL SPOTTING EVALUATION: The solutions used in the evaluations were: sulfuric acid solutions at concentrations of 1 N, 10^{-2} N, and 10^{-4} N; deionized water; saturated sodium sulfate; and acid rain, at concentrations of 1 N and 10^{-2} N.

Painted panels were exposed to each of the test solutions for durations of 50, 100, 500, 1,000, and 5,000 min. All exposures were carried out at room temperature (about 20°C) and ambient humidity (approximately 35% relative humidity).

The samples of acid rain were prepared from a mixture of 65.5, 20.7, and 13.8 equivalent percent sulfuric acid, nitric acid, and hydrochloric acid, respectively.[4] The test solutions were placed on the panels in the same order each time. Approximately 1.5 mL of solution with an average exposure diameter of 20 mm was placed at each exposure location. During the exposure, water lost by evaporation was replaced twice a day with deionized water. After exposure, the panels were immersed in water for either one-half the exposure time or two hours, whichever was shorter. The panels were allowed to dry thoroughly and then evaluated using visual inspection, light, microscopy, and profilometry.

CONTROLLED CONCENTRATION EXPOSURE: Panels were painted using the conditions in *Table* 3. The painted panels were then cut into 2.5 × 5.0 cm (1 × 2 in.) sections for exposure. The edges of the samples were taped to prevent the solutions from attacking the paint at the edges and lifting the coating. The acid solution used in these studies was comprised of 70 equivalent percent sulfuric acid (H_2SO_4), 25 equivalent percent nitric acid (HNO_3), and 5 equivalent percent hydrochloric acid (HCl). A 1 N stock solution was prepared and lower concentrations were made by dilution. The samples were then immersed in a test solution which had been equilibrated at the desired temperature. The immersion tests were carried out in a sealed container, therefore, the concentration of the acid solution remained constant during the exposure. Immersion times varied from 10 to 10^5 sec (27.7 hr).

Light Microscopy

Light microscopy was carried out using a Leitz Ortholux® microscope at magnifications of 50X to 585X. Crossed polarizing filters were used as needed to enhance the contrast of the micrographs and to differentiate between crystalline deposits, highly strained regions, and holes in the matrix. Exposure areas were surveyed for damage using light microscopy.

Fluorescent Microscopy

Fluorescent microscopy was carried out following the method of Cheever.[6] For the initial fluorometric work, 1 mL drops of the acid rain solution containing 0.1% (wt/wt) disodium fluorescein were placed on the panel of interest and exposed to ambient conditions. These drops were allowed to stay on the panel from four to eight hours after which they were removed by rinsing with distilled water. Later investigations utilized samples exposed by immersion (described under Panel Preparation) in a 0.2% (wt/wt) acidic solution of Tinopal® BL fluorescent dye.[7]

The fluorescent microscope was a Leitz Orthoplan® unit equipped with a Xenon light source and a photometer for measuring the intensity of the reflected fluorescent light (measured in volts). The microscope was also equipped with a stepping stage which allowed scanning through the thickness of the coating (3.1 μm[8] and 1.0 μm[9] step size).

Table 2—Materials

Material Designation	Type of Material or Chemical Name	Source
Mel-1	Rigid melamine-acrylic clearcoat	—
Mel-2	Rigid melamine-acrylic clearcoat	—
NAD	27% non-aqueous dispersion lacquer	—
MEK	Methyl ethyl ketone	Fisher Scientific
Xylene	Xylene	Fisher Scientific
Fluorescein	Disodium fluorescein	Kodak
Tinopal® BL	Disodium sulfonate of distyrylbiphenyl	PPG/Chemfil
H_2SO_4	Sulfuric acid	Baker
HNO_3	Nitric acid	Baker
HCl	Hydrochloric acid	Baker

Table 3—Paint Sample Preparation Conditions

Mel-1	Substrate	Cold-rolled steel	Bonderite® 40 phosphate system
	Primer	ELPO	
	Basecoat	White, 21 s Fisher #2	
	Application	Gun	DeVilbiss - JGA-502, Suction feed
		Fluid tip	FF
		Number of passes	3 single
		Gun distance	10 in.
		Gun index	3.5 in.
		Air pressure	60 psi
		Traverse speed	2.0 ft/s
	Clearcoat	High solids rigid clearcoat	
		45 s Fisher #2	
	Application	Gun	DeVilbiss -JGS-502, Suction feed
		Fluid tip	EX
		Number of passes	2 single
		Gun distance	10 in.
		Gun index	3.5 in.
		Air pressure	60 psii
		Traverse speed	2.5 ft/s
Mel-2	Substrate	Cold-rolled steel	Bonderite 40 phosphate system
	Primer	ELPO	
	Basecoat	Medium garnet red metallic	
		21 s Fisher #2	
	Application	Gun	DeVilbiss - JGA-502, Suction feed
		Fluid tip	FX
		Number of passes	3 single
		Gun distance	10 in.
		Gun index	3.0 in.
		Air pressure	60 psi
		Traverse speed	1.8 ft/s
	Clearcoat	High solids rigid clearcoat	
		33 s Fisher #2	
	Application	Gun	DeVilbiss -JGS-502, Suction feed
		Fluid tip	FF
		Number of passes	4 single
		Gun distance	10 in.
		Gun index	3.0 in.
		Air pressure	60 psi
		Traverse speed	2.2 ft/s
	Flash 5 min between basecoat and clearcoat		
	Flash 15 min betwen clearcoat and bake		
	Bake 32.5 min at 121°C (250°F)		

After exposure, the samples were cut into 2.5 × 2.5 cm (1 × 1 in.) coupons, polished on edge using mineral spirits as the lubricant and examined with the fluorescent microscope to determine the penetration distance of the test fluid into the paint sample. Samples evaluated using 0.1% disodium fluorescein were examined in three areas with 3.1 μm steps and the resulting voltages were averaged. Samples exposed to 0.2% Tinopal BL were examined in six areas with 1.0 μm steps and the results averaged.

The fluorescent microscope has three filters which permit different wavelengths of reflected light to be transmitted and measured by the photometer. They are:

(1) Bright-field, i.e., normal visible spectrum, 400-700 nm;

(2) Blue reflected fluorescent light, 400-430 nm (Tinopal BL), and

(3) Yellow reflected fluorescent light, 510-515 nm (disodium fluorescein).

Bright-field illumination is very sensitive to the reflectivity of the sample. Therefore, the white basecoat, the gray ELPO primer, and polished steel substrate would reflect more energy and yield higher voltages than the clearcoat. Bright-field illumination was used to determine the thickness, location, and identification of each paint layer.

Profilometry

Surface profilometry was carried out using a Gould 1201 Surfanalyzer. The purpose of this measurement was to determine the approximate magnitude of the damage and whether the damage took the form of swelling, pitting, or a combination of the two.

Extended Period Immersion Experiments

Free clearcoat films were prepared by casting onto glass plates and equilibrated at room temperature and

Table 4—Combinations of Acid Concentrations Exposure Temperatures, and Exposure Times Used for Differential Scanning Calorimetry Analysis

Exposure Temperature °C	Acid Concentration Normality	Exposure Time, Seconds					
		10^1	10^2	10^3	10^4	10^5	LT[a]
22	1	—	—	X	—	—	X
	10^{-2}	—	—	X	—	—	X
	10^{-4}	—	—	X	X	X	X
	10^{-6}[b]	—	—	X	X	X	X
40	1	X	X	X	—	X	—
	10^{-2}	X	X	X	—	X	—
	10^{-4}	—	—	X	X	X	—
	10^{-6}	—	—	X	X	X	—
70	1	X	X	X	—	—	—
	10^{-2}	X	X	X	—	—	—
	10^{-4}	—	—	X	—	—	—
	10^{-6}	—	—	X	X	X	—

(a) Long-term exposure = ~500 hr (~ 3 weeks).
(b) Extrapolated normality of distilled water (CO_2 not removed).

ambient relative humidity. Samples were then immersed in distilled water, 1 N, 10^{-2} N, and 10^{-4} N acid solutions (approximate pH of 0, 2, and 4, respectively) at room temperature for extended times. The weights of these films were recorded daily.

Differential Scanning Calorimetry Analysis

Clean 10 × 30 cm (4 × 12 in.) glass plates were treated with chlorotrimethyl silane followed by heating to 100°C for 30 min to drive off volatiles. This allowed easy removal of the clearcoat films that were cast on the glass plates. Uniform 5 μm films were obtained by using a doctor blade. The clearcoats were allowed to flash for 10 min at room temperature followed by a cure of 40 min at 121°C (250°F). The films were sectioned into approximately 0.5 × 10 cm strips and removed from the plates as needed.

Table 4 shows the exposure conditions used in this study. After removal from the solutions, 5 mm circular sections of each sample were obtained by using a cork borer to remove sections from the sample strips. Then, 14 to 24 of the circular sections were placed in a thermal analysis pan, and the experiment done immediately.

The thermal characteristics of the clearcoat films exposed to varying conditions of acid concentration, exposure time, and exposure temperature were determined by differential scanning calorimetry (DSC). The sample size was 10-20 mg and the temperature range was –50 to 150°C. All of the samples were heated at a programmed

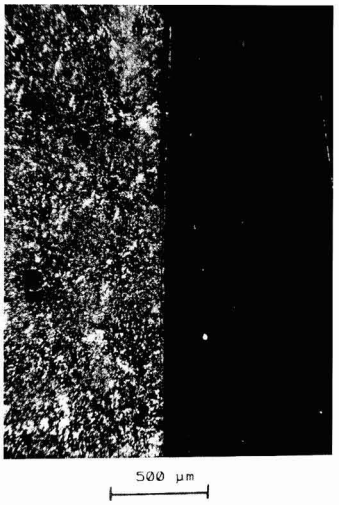


Figure 1—Deposition from Na_2SO_4 before and after gentle wiping. Original magnification: 50X.

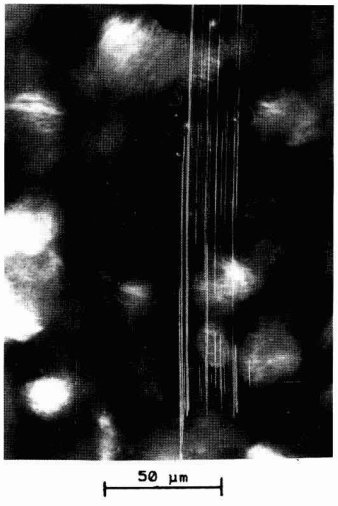


Figure 2—The control surface of a basecoat/clearcoat enamel paint system. Original magnification: 585X.

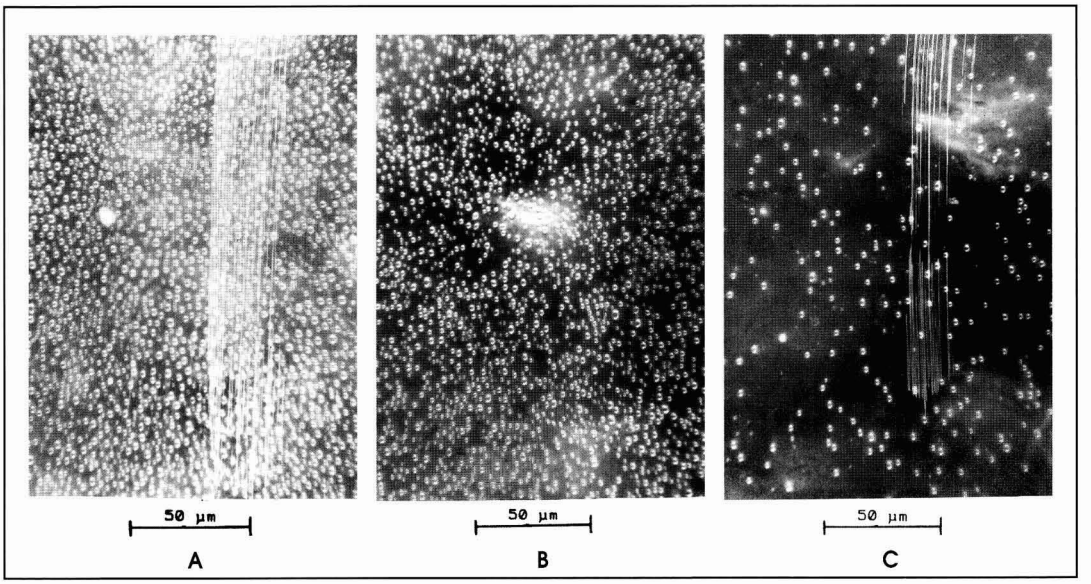


Figure 3—Progression of bubbling with increased distance from the core area. Original magnification: 585X. (A) In the halo adjacent to the core; (B) in the flume, 3 mm from the core; and (C) in the plume, 155 mm from the core.

rate at 10°C per minute using a DuPont 1090 Thermal Analyzer equipped with a DuPont 912 DSC cell. Multiple scans were taken with each sample to determine the instrumental uncertainty.

Infrared Spectroscopy

Infrared spectroscopy was carried out using a Nicolet 20 SX spectrometer. Samples of the exposed coatings were held against a germanium sample cell and the attenuated total reflectance infrared spectrum recorded. Pseudo-first order kinetics were determined in graphing in (peak height/reference peak height) versus exposure time.

RESULTS AND DISCUSSION

Spotting Exposure Experiments

Changes Common to All Paint Samples: In the majority of cases, it was difficult to locate the deionized water exposure site. In some cases, a slight distortion of the coating surface, caused by small bubbles and micro-peeling, was found under high magnification. Damage in the deionized water site was always accompanied by a plume from an adjacent acid rain test site. Consequently, it was concluded that the acid was absorbed into the deionized water leading to the observed damage.

As expected, a salt was found over the concentrated sodium sulfate exposure sites. It was easily removed by wiping, and no distortion or damage to the coating surface was found (see *Figure* 1).

Specific Exposure Results: In all the experiments, the black solid basecoat and the garnet red metallic basecoat performed in a similar manner.

1 N Sulfuric Acid—At 100 min, profilometry revealed a slight swelling of the exposure area. A slight visual distortion in the coating, caused by bubbles, was found for samples exposed for 500 min. At 1,000 min, a darkening of the core and blisters were found which could be seen either visually or under low magnification. Edge effects became apparent with 30 µm being the maximum rise of the coating and 14-16 µm being the maximum depth of the etch. At 5,000 min, both clearcoat and basecoat were found to be lifted from the ELPO layer. Blisters as well as crazing and bubbles were found in the halo. Profilometry showed substantial blistering, height of 200 µm, and etching, depth of at least 60 µm, approximately the combined thickness of the basecoat and the clearcoat.

10^{-2} N Sulfuric Acid—After 1,000 min at this lower acid concentration, there was distortion in the core caused by bubbles and scattered blisters. Profilometry revealed an edge effect with a maximum depth of 16 µm. At 5,000 min, the major features in the core were bubbles and blisters. The maximum depth of the etch had not changed, and the maximum height of the blisters was 6 µm.

10^{-4} N Sulfuric Acid—After 500 min exposure to the most dilute acid, an area of distortion caused by small bubbles at the edge was found. This was also the case for the 1000 min exposure. At 5,000 min, the damage in the core was found to be caused by crazing and bubbles with some micro-peeling evident.

1 N Acid Rain—The effects of acid rain on this coating occurred sooner and were more severe after the same

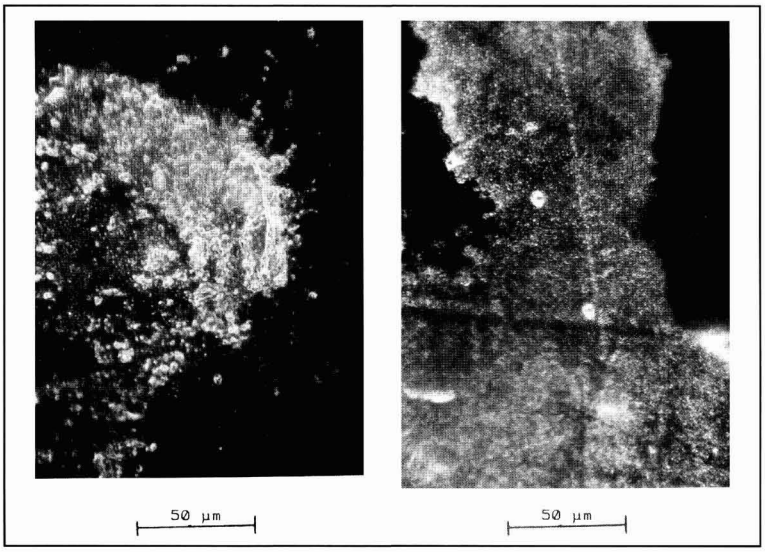


Figure 4—Micrographs of paint damage found in the field. Original magnification: 585X.

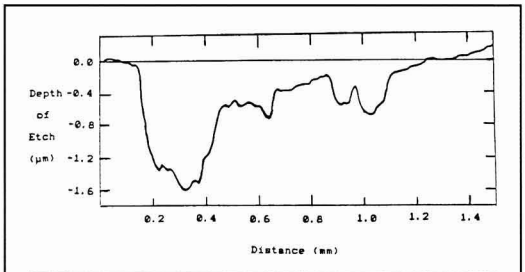


Figure 5—Profilometry of paint damage found in field.

period of time than the effects of sulfuric acid. Also, the degree of damage to the black BC/CC at this acid concentration generally was not as great as that found for the red BC/CC at the same concentration. At 100 min, a slight swelling in the coating was found by profilometry. At 500 min, blisters and bubbles of various sizes were found in the core. In the halo, there were evenly distributed bubbles of uniform size, but the bubbles decreased in concentration as the distance from the core increased (*Figures* 2 and 3 a, b, and c). The total diameter for the core and halo as determined from profilometry was 16 mm. However, the core was 10 mm wide with a maximum depth of 4-10 µm, while the halo was 3 mm on each side with a depth of 6 µm and a maximum blister height of 6 µm. At 1,000 min, the blackened core had increased its maximum etch depth to 8-13 µm, and blisters were measured up to 8 µm above the surface. At 5,000 min, severe cracks as far down as the ELPO and multiple cores as well as a salt deposition or a coating residue were present. The clearcoat was separated from basecoat, and the basecoat was separated from the ELPO with extensive cracking in both layers. Sections of the core had lifted from the substrate while in other areas the maximum depth of the damage was 18 µm.

10^{-2} N Acid Rain—After 500 min exposure of the coating to this more dilute solution, a core typified by cracks, blisters, and small bubbles was found. Profilometry showed that the maximum depth of damage at the edge was 11-24 µm. After 1,000 min, the damage appeared to be approximately the same, a network of small cracks and blisters. The maximum penetration, 14-16 µm, occurred at the sides of the etch. For the 5,000 min exposure, there were multiple cores and, under magnification, small blisters and cracks were seen. The etches were 15-22 µm deep with blisters 3.6 µm above the original surface.

General Observations: The chemicals chosen for this evaluation, sulfuric acid, sodium hydroxide, sodium sulfate, and acid rain, were representative of the types of inorganic pollutants that might be expected in the environment. The sulfuric acid was chosen not only for its acidic effects, but because it is also the most commonly found acid in the environment. The concentration ranges used, 1 N, 10^{-2} N, and 10^{-4} N, represent realistic acid concentrations which a coating might be exposed to either from acid particulates or rain. A sulfate salt was included because sulfates are commonly reported as a part of atmospheric deposition, and deionized water was included as a control. The acid rain deposition chosen for this work was within the composition range of normally reported acid rain.[4]

The spotting studies were carried out at room temperature. On standing at room temperature, the acid solutions became concentrated due to evaporation; and the diameter of the exposure sites was reduced

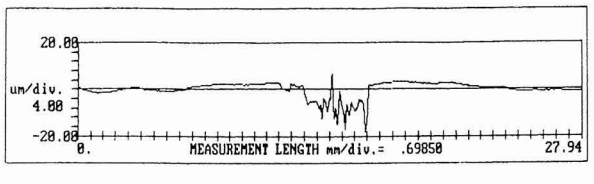


Figure 6—Profilometry of 10^{-2} N acid spotted laboratory sample showing swelling and etching.

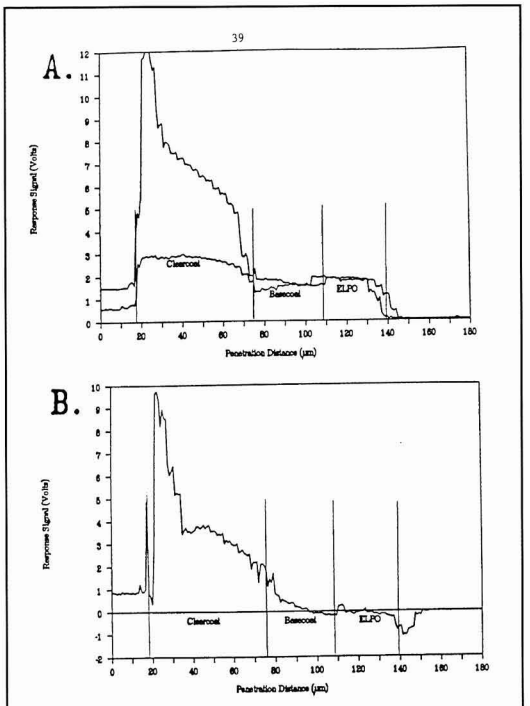


Figure 7—Fluorescent light intensity as a function of depth using 0.1% disodium fluorescein dye (22°C and ~35% relative humidity with an exposure time of six hours). (A) Exposed and control curves; and (B) control curve substrated.

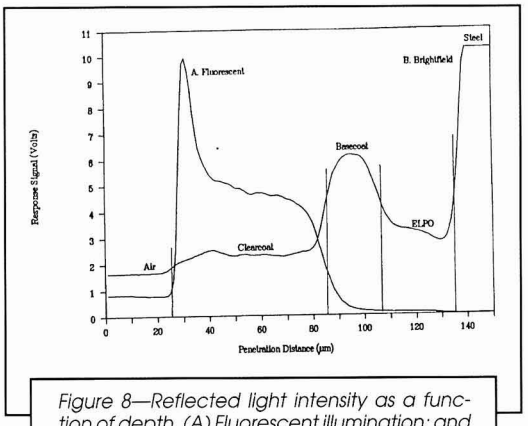


Figure 8—Reflected light intensity as a function of depth. (A) Fluorescent illumination; and (B) bright-field illumination.

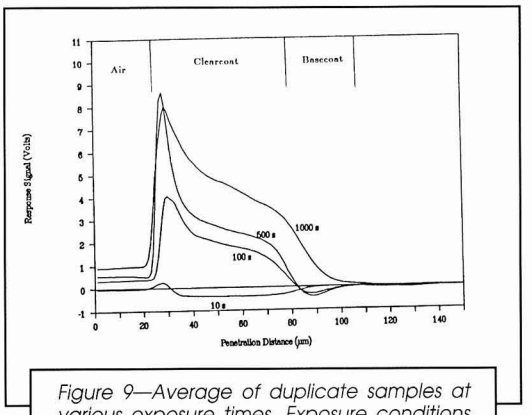


Figure 9—Average of duplicate samples at various exposure times. Exposure conditions were 0.2% w/w Tinopal BL dye, exposure temperature was 70°C, samples exposed by immersion.

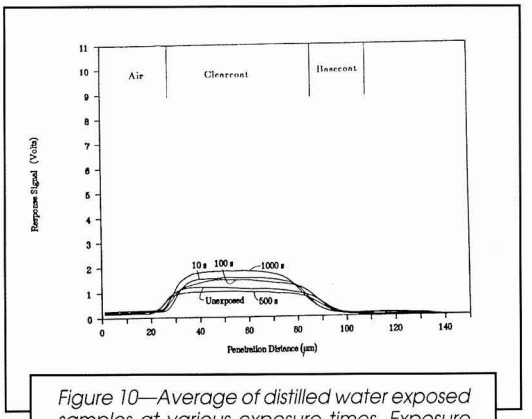


Figure 10—Average of distilled water exposed samples at various exposure times. Exposure conditions were 0.2% w/w Tinopal BL dye, exposure temperature was 70°C, samples exposed by immersion.

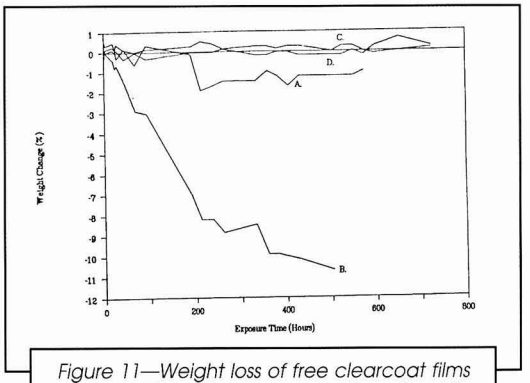


Figure 11—Weight loss of free clearcoat films immersed in various concentration of acidic solution at room temperature. (A) Distilled water; (B) 1 N acid solution; (C) 10^{-2} N acid solution; and (D) 10^{-4} N acid solution.

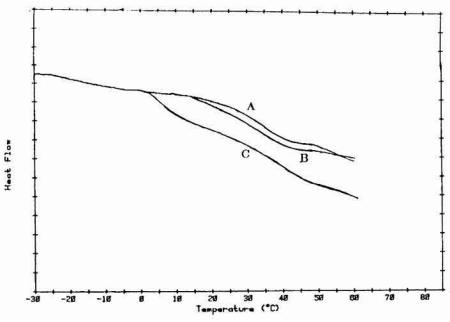


Figure 12—Plot of heat flow vs. temperature for clearcoat samples held at constant acid concentration (1 N, ~pH 0) and exposure temperature (70°C). (A) 10 sec exposure; (B) 100 sec exposure; and (C) 1,000 sec exposure.

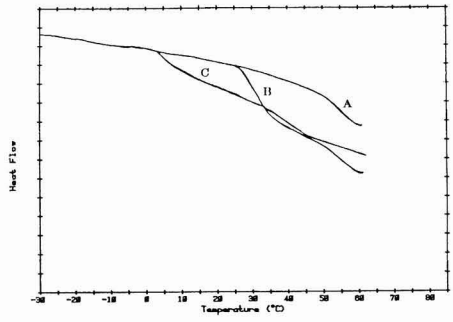


Figure 13—Plot of heat flow vs. temperature for clearcoat samples held at constant acid concentration (1 N, ~pH 0) and exposure time (1,000 s, 16.6 min). (A) 20°C; (B) 40°C; and (C) 70°C.

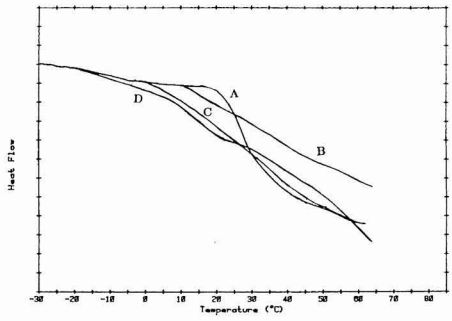


Figure 14—Plot of heat flow vs. temperature for clearcoat samples held at constant exposure temperature (40°C, 105°F) and exposure time (10^5 s, 27.7 hr). (A) distilled water; (B) 10^{-4} N acid concentration; (C) 10^{-2} N acid concentration; and (D) 1 N acid concentration.

from about 20 mm upon first addition to about 15 mm for 1 N acids, 3 mm for 10^{-2} N acids, and <1 mm for 10^{-4} N acids. After 500 min, damage to the coating was found at the exposure sites. Before 500 min, the acidity did not increase enough for damage to occur, and the only change was a slight swelling of the coating. As a result of these observations, we conclude that concentrations of acid higher than those we tested are required to cause significant damage in a short period of time at room temperature. At higher temperatures these time-concentration relationships may be different.

Basecoat/Clearcoat Systems: Sulfuric acid and acid rain damage can be extensive with lifting, cracking, and blistering leading to the destruction of the coating. Short times and/or low concentrations lead to less damage, whereas high concentrations and/or long times lead to more damage. The only effect of concentrated sodium sulfate solution was to leave a deposition which could be removed easily with gentle wiping. In most cases, deionized water caused no damage; however, in a few cases, the damage was similar to that caused by 10^{-4} sulfuric acid. As stated previously, in these samples the damage was caused by acid contamination from the adjacent acid rain exposure sites.

Non-Aqueous Dispersion Lacquer Systems: For comparison with the basecoat/clearcoat enamel system, we also investigated a non-aqueous dispersion lacquer (NAD) coating system. With this system sulfuric acid damage was limited to darkening of the coating with small amounts of crazing and bubble formation. Damage from the acid rain mixture was more severe than that from the sulfuric acid. More concentrated solutions and longer times lead to increased damage. The base damage was comprised of light etching along with a darkening of the metal flake. Concentrated sodium sulfate left a deposition which was easily removed. Deionized water sites exhibited change on only three panels out of the 12 examined. In these cases, we feel that the changes are due to contamination of the exposure site by the adjacent acid rain exposure.

Comparison of Basecoat/Clearcoat Enamel and Non-Aqueous Dispersion Lacquer Paint Systems: Acid damage, both sulfuric acid and acid rain, was more severe for the BC/CC systems, occurred at shorter times and with a greater degree of damage than for the NAD systems. With the NAD systems, the most noticeable effect is a decrease in the reflectance of the metal flake caused by exposure to base. However, the greatest amount of damage to the NAD systems was with the acid rain solutions. Concentrated sodium sulfate solutions and deionized water cause no permanent damage with either system.

The reasons for the differences between the paint systems are tied to the differences in the way the films are formed. An enamel, such as the BC/CC systems, is a high-solids low viscosity paint which is prepared from a solution of low molecular weight prepolymers. During baking, these prepolymers crosslink to form a network. The physical properties of this film are derived from this crosslinked network. If too few crosslinks are made initially or if they are destroyed during use, then the film is

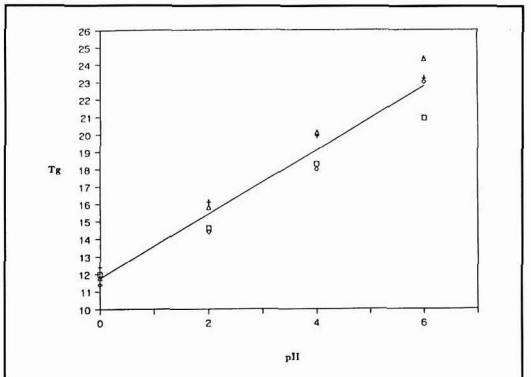


Figure 15—Regression of T_g vs. acid solution concentration for extended exposure of clearcoat samples at room temperature. The different symbols represent repeated experiments.

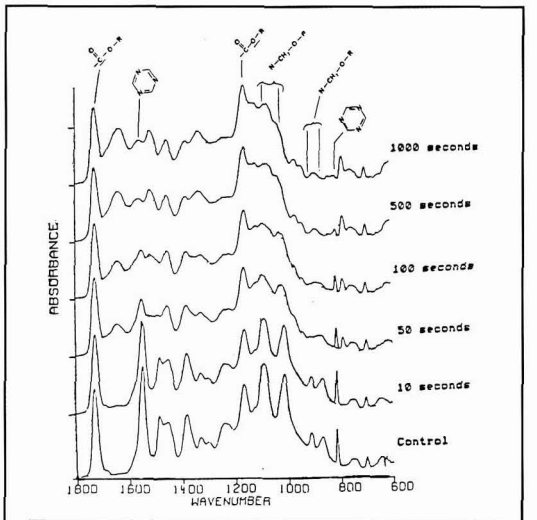


Figure 16—Infrared spectra of Mel-1 clearcoat for various exposure times at 70°C with 1 N acid solution.

easily damaged. It is shown in the literature that these crosslinks are susceptible to acid attack.[10]

The NAD system is a suspension of high molecular weight polymers in a mixture of solvent and non-solvent. When applied these materials behave as lacquers. With this type of paint, films are formed by the evaporation of the solvents. The physical properties of this film are derived from the modulus of the acrylic backbone and do not depend upon a crosslinked network. Since crosslinks are not present in this coating, acids should have less of an effect. The acids may attack the side chains of the polymer and eventually the backbone, however, these materials are much more resistant to degradation than the crosslink sites of the enamel. Therefore, damage by acids will occur, but it will require longer times.

The coatings are also applied differently. The BC/CC is applied in two separate operations, where the pigments and metal flakes are separated from the surface of the coating by an intervening layer of clearcoat. The NAD, on the other hand, is applied as a single layer containing both the resin and the pigments. Therefore, the metal flake in the NAD is closer to the surface and may be exposed to acids or bases at earlier stages of the exposure. This allows the metal flake in the NAD system to be more readily affected by the solutions than the metal flake in the BC/CC system.

Comparison of Current Work with Damage From Field Exposures: We obtained a sample of a basecoat/clearcoat painted vehicle which had been damaged by atmospheric fallout. Visually and microscopically, the field inflicted damage appeared comparable to the damage found for our laboratory samples after being exposed to acid concentrations 10^{-2} and 10^{-4} N for 500 min (*Figure* 4). The size of the damaged areas was about 1-3 mm in diameter, and profilometry measurements of several of these spots found them to be mildly etched (1-2 µm, *Figure* 5). Profilometry of the spotted panels has demonstrated that both swelling and etching occur for acid exposures and that the type of damage is dependent upon the exposure time (see *Figure* 6).

Fluorescent Microscopy: Representative results of acid/dye solution penetration in basecoat/clearcoat systems are presented in *Figures* 7-10. *Figure* 7a is a graph of fluorescent light intensity (measures in volts) versus penetration depth with a 1 N acid solution containing 0.1% (w/w) disodium fluorescein. A control tracing using the same dye concentration in distilled water is also presented. *Figure* 7b shows the acid exposed trace with the control trace subtracted. The curve shape was essentially unchanged by the subtraction, but the intensity was reduced. Duplicate samples were found to be identical within experimental error.

While disodium fluorescein was initially very soluble in the acid solution, it had a limited usefulness. The dye

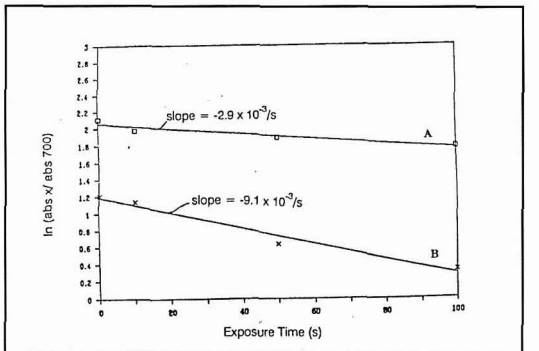


Figure 17—Regression of ln (peak absorbance) vs. exposure time for Mel-1 clearcoat. (A) Ester aborbance–1730 cm^{-1}; and (B) triazine absorbance–815 cm^{-1}.

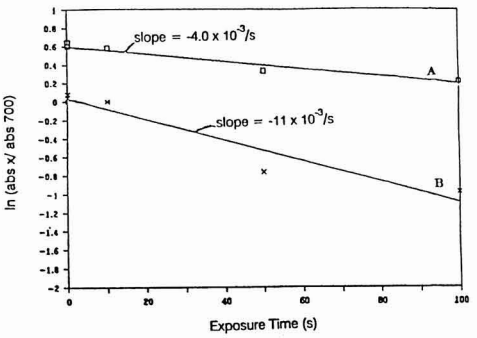


Figure 18—Regression of ln (peak aborbance) vs. exposure time for Mel-2 clearcoat. (A) Ester aborbance–1730 cm^{-1}; and (B) triazine absorbance–815 cm^{-1}.

became increasingly insoluble in the test solutions with time due to reactions with the acid. In addition, the fluorescence of the fluorescein is in the same region as materials contained in the ELPO. This meant that all the measurements had to be carried out as comparisons with unexposed material with the ELPO auto-fluorescence substrated. Subsequent experiments were carried out using a more acid resistant fluorescent dye, Tinopal BL, in order to minimize these difficulties.

Constant Concentration Exposure Experiments

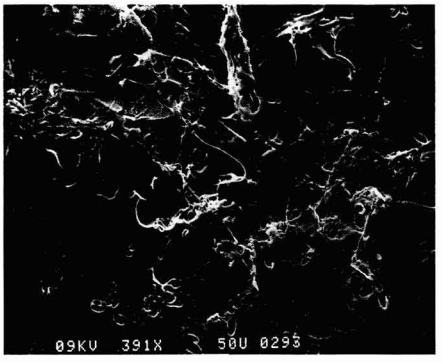
FLUORESCENT MICROSCOPY: *Figure* 8 is a composite bright-field and fluorescent tracing of the response voltage versus the penetration distance into a basecoat/clearcoat sample which was immersed for 500 sec at 70°C in 1 N acid solution containing 0.2% Tinopal BL. Each layer is identified on the figure. The fluorescent light trace shows that there is an intense region of absorbed dye in the upper 15 μm of the clearcoat followed by a uniformly decreasing concentration in the remaining 60 μm of the clearcoat. The intensity of the dye decreases rapidly in the basecoat, and no dye is detected in the ELPO primer.

Figure 9 shows the average fluorescent traces for duplicate experiments of basecoat/clearcoat samples exposed to 1 N acid solution at 70°C for exposure times of 10, 100, 500, and 1000 sec. In this experiment a heated but otherwise unexposed control has been subtracted from the samples. These traces show that the dye containing material has completely penetrated the thickness of the clearcoat in 100 sec or less. A region of higher intensity is seen in the first 10-15 μm from the air/clearcoat interface. This feature is similar to that seen with the fluorescein experiments. The longer exposure times show increased fluorescent intensity indicating further penetration of the dye into the clearcoat. At all of the exposure times, the fluorescent intensity decreases with depth.

This is not the case with distilled water exposure. *Figure* 10 shows the dye absorption results for basecoat/clearcoat samples which were immersed in distilled water at 70°C. The exposure times were 0 (unexposed), 10, 100, 500, and 1,000 sec. The figure shows that the fluorescent dye intensity is low compared to the acid exposures and that no dependence on exposure time is seen. Rather the curves seem to cluster around a fixed intensity. The variance between these curves was approximately 0.7 volts. The amount of dye uptake is within this experimental error over this time range; therefore, there is no evidence from fluorometry to support significant distilled water uptake over that present in the room temperature/ambient humidity equilibrated samples under these conditions.

Mass uptake experiments carried out using samples equilibrated at room temperature and relative humidity showed no weight gain but rather a weight loss. Weight loss data from exposure of free clearcoat films at room temperature (~25°C) in solutions of 1 N, 10^{-2} N, 10^{-4} N acid solutions, and distilled water is presented in *Figure* 11. No significant weight changes occurred with the samples exposed to the 10^{-2} N, and 10^{-4} N acid solutions under these conditions. Samples exposed to the 1 N acid solution exhibited large weight losses

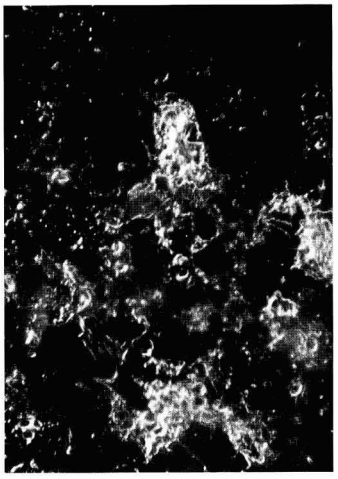
A



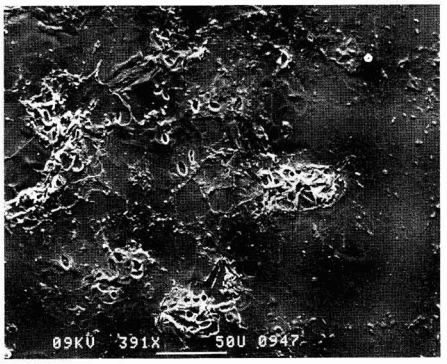
B

Figure 19—Micrographs of laboratory generated spot from 10^{-4} N acid solution at room temperature. Section A (original magnification: 390X). (A) light micrograph; and (B) scanning electron micrograph.

beginning as early as 100 hr. In addition to the weight loss, the samples exposed to the 1 N acid solution showed physical changes, i.e., softening. This is clear evidence that the coating structure is being attacked by the acidic solution. Some parts of the coating are being solubilized and removed, thereby causing the loss in mass. Samples immersed in distilled water also appear to show a small mass loss. Since this loss occurs in one weighing period and the mass then remains constant, it is most likely due to other chemical changes.



A



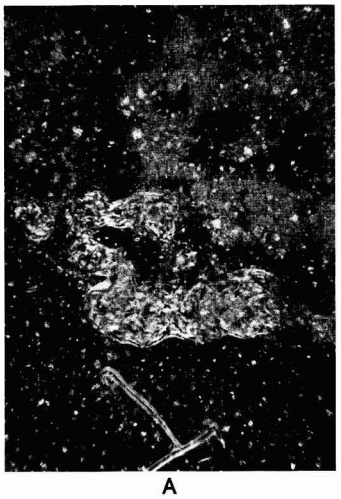
B

Figure 20—Micrographs of laboratory generated spot from 10^{-4} N acid solution at room temperature. Section B (original magnification: 390X). (A) Light micrograph; and (B) scanning electron micrograph.

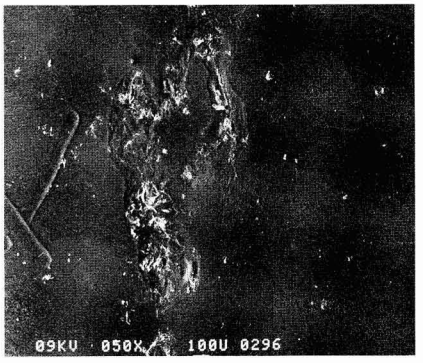
Differential Scanning Calorimetry Analysis: The exposure conditions used in this section were obtained by varying the acid concentration, the exposure time, and the exposure temperature and are shown in *Table* 4. Over the course of the study, it was found that films cast at different times had different initial glass transition temperatures (T_gs). Therefore, using samples from different castings gave inconsistent results. With the exception of the long-term studies, all experiments for the DSC analysis were performed on samples obtained from the same casting. In addition, the same samples were analyzed a number of times. These results showed that the onset of the T_g did not vary more than the scatter between different samples. Therefore, we conclude that the changes due to the water/acid absorption are permanent and involve some type of chemical reaction. These multiple analyses also failed to indicate the presence of free water on subsequent runs, another indication of a chemical reaction.

Figure 12 shows a representative constant concentration and temperature series where the acid concentration was 1 N, the exposure temperature was 70°C, and the exposure times were 10, 100, and 1,000 sec. Since sharp T_g transitions were the exception for this study, deviations from the baseline scans were assumed to indicate changes in the onset temperature within each series. With this series, as the exposure times increase, the onset temperature for the transition moves to a lower temperature. This shows a dependence of the onset of T_g with the exposure time.

Figure 13 shows a representative constant concentration and time series where the acid concentration was 1 N, the exposure time was 1,000 sec, and the exposure temperatures were 22, 40, and 70°C. With this series,



A



B

Figure 21—Micrograghs of laboratory generated spot from 10^{-4} N acid solution at room temperature. Section C (original magnification: 390X). (A) Light micrograph; and (B) scanning electron micrograph.

Table 5—Results of Infrared Kinetic Analysis (Exposure Temperature = 70°C, Acid Concentration = 1 N)

Exposure Seconds	Peak Height (mm)			(Peak Ratio)			ln(Peak Ratio)	
	1735 cm^{-1}	815 cm^{-1}	700 cm^{-1}	1735 cm^{-1}	815 cm^{-1}	700 cm^{-1}	1735 cm^{-1}	815 cm^{-1}
Mel-1								
Control	37	15	4.5	8.22	3.33	1.00	2.11	1.20
10	32.5	14	4.5	7.22	3.11	1.00	1.98	1.13
50	29.7	8.5	4.5	6.60	1.89	1.00	1.89	0.64
100	27.7	6.5	4.7	5.89	1.38	1.00	1.77	0.32
500	26.7	1.5	5.0	5.34	0.30	1.00	1.68	−1.20
Mel-2								
Control	22	12	11.5	1.91	1.04	1.00	0.65	0.04
Heat only	21	11.5	11.5	1.98	1.00	1.00	0.60	0.00
Water + heat	22	13	12.0	1.83	1.08	1.00	0.61	0.08
10	25	14	14	1.79	1.00	1.00	0.58	0.00
50	21	7	15	1.40	0.47	1.00	0.34	−0.76
100	20	6	16	1.25	0.38	1.00	0.22	−0.98
500	22		18	1.22		1.00	0.20	

increasing exposure temperature pushed the onset of T_g to a lower value.

Figure 14 shows a representative constant temperature and time series where the exposure temperature was 40°C, the exposure time was 105 sec, and the acid concentrations were 1 N, 10^{-2} N, 10^{-4} N, and distilled water. With this series, increasing the acid concentration led to a decreased temperature for the onset of the T_g.

Summarizing the short-term exposure information, the onset T_g decreases with increasing exposure time, increasing exposure temperature, and increasing acid concentration. This is the trend which would be expected if a chemical reaction between the acid solution and the coating was involved. The only exceptions to these trends occurred for either low acid concentrations or short exposure times. Since the changes occurring in the film under these conditions are very slight, small differences in technique may account for the discrepancies.

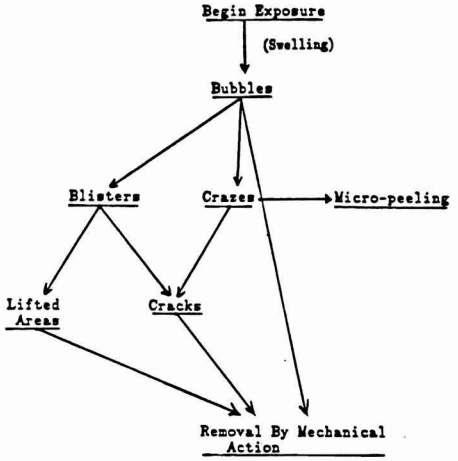


Figure 22—Schematic of the progression of damage.

The long-term exposure data represent a special case where equilibria within the films may have been achieved and for this reason as well as this series being from a different casting these data were not included with any of the other series. As opposed to the previous series, the onset T_gs for this series were very pronounced. When the acid concentration is plotted versus the T_g of the sample a straight line results as shown in *Figure* 15.

INFRARED SPECTROSCOPY: The results of the kinetic analysis are shown in *Table* 5 and a series of infrared spectra of the Mel-1 coating exposed at 70°C and 1 N acid concentration for various times is shown in *Figure* 16. In order to work with constant contact area samples from the ATR, all the bands of interest were referenced to the styrene band at 700 cm^{-1}. These results show that the first groups affected by the acidic solutions are the unreacted alkoxy methyl groups of the melamine resin. These absorbances are located at 913 and 870 cm^{-1}. In our evaluations, these groups are essentially removed within the first 50 sec of exposure. In order to examine the kinetics, graphs were made of the ln(relative absorbance) versus the exposure times. These graphs were straight lines with the slope of the line proportional to the reaction rate. The triazine ring absorbances at 1540 and 815 cm^{-1} exhibit first order degradation kinetics. *Figures* 17 and 18 graphically show the kinetics results for both of the melamine-acrylic coatings, Mel-1 and Mel-2. In both of these cases, heat alone or heat and distilled water exposure do not cause chemical changes in the film. This is consistent with Bauer's work[10,11] which shows that the melamine crosslink is attacked under mildly acidic conditions. The ester groups in the acrylic backbone, 1730 cm^{-1}, appear to have only been slightly damaged.

MICROSCOPY OF ACID ETCHED AREA: A 10^{-4} N acid solution (approximately pH 4) was placed on the surface of a melamine-acrylic clearcoated panel and allowed to dry at ambient temperature and relative humidity. A grid

system was then established so that identical areas could be imaged by both light and scanning electron microscopy (SEM). SEM of the same areas as examined with light microscopy were prepared and both micrographs are shown for several areas in *Figures* 19-21.

Folding of the clearcoat was clearly seen in both light and electron micrographs (see *Figure* 19). As seen in *Figure* 20, some of the features which appear to be bubbles with the light microscope are observed to be craters or holes in the surface of the clearcoat. However, as shown in *Figures* 20 and 21, not all of the bubbles are on the surface. Some bubble-like features are observed in the electron micrographs to be bumps. This shows that the bubbles are actually both on the surface and in the interior of the clearcoat. In addition, it is clear that electron microscopy and light microscopy are imaging the same surface features and that most of the surface disruption is a result of folding and cratering of the clearcoat.

SUMMARY

Through examination of the data, it becomes apparent that the acid attack on both the BC/CC and NAD systems follows a general progression (*Figure* 22). The effects on the BC/CC system occur much more rapidly and progress to a much greater degree than for the NAD system. In the early stages, swelling of the coating can occur. Bubbles (small blisters) are formed in the coating, usually around the edge of the exposure area. These bubbles can then increase in size, form blisters, or form crazes. If the surface is wiped, then part of the material forming the bubbles is removed and what remains is considered to be a residue. At later stages, the bubbles spread to cover the entire damaged area (core, halo, and plume). Blisters formed earlier can either crack or coalesce to form lifted areas which may then crack. The crazes may intensify to form visible cracks or facilitate the removal of material from the surface. The lifted areas and the severely cracked areas are highly susceptible to removal by mechanical action (i.e., scrubbing, wiping, etc.).

This investigation also shows that:

(1) When using room temperature and ambient relative humidity equilibrated samples, distilled water is not absorbed to an extent measurable by fluorometry in the clearcoats while acidic solutions are absorbed.

(2) Acidic solutions completely penetrate the coatings in relatively short times at elevated temperature. This leads to the potential for decomposition.

(3) Increased time, acid concentration, and temperature of exposure cause greater changes to the onset T_g with clearcoat material as measured by DSC. Infrared spectroscopy indicates a chemical degradation with pseduo-first order reaction rate kinetics.

ACKNOWLEDGMENT

The authors would like to acknowledge the invaluable assistance of Dr. D. McEwen for his work with the ATR infrared spectroscopy, Mr. G. Lalonde for his help with profilometry measurements, Mr. C. Wong for the scanning electron microscopy, and Ms. P.A.P. Ngo and Mr. C. McInnis for their valuable discussions, assistance, and ideas during this investigation.

References

(1) Pierson, W.R., Brachaczek, W.W., Gorse, R.A., Japar, S.M., Norbeck, J.M., and Keeler, G.J., "Acid Deposition and Atmospheric Chemistry at Allegeny Mountain," in *The Chemistry of Acid Rain*, Johnson, R.W., Gordon, G.E., Calkins, W., and Elzerman, A.Z. (Eds.), ACS Symposium Series 349, American Chemical Society, Washington, D.C., pp. 28-38, 1987.

(2) National Acid Precipitation Assessment Program (NAPAP), "Interim Assessment, The Causes and Effects of Acidic Deposition," Volume 2, Emissions and Control, Washington, D.C., 1987.

(3) National Acid Precipitation Assessment Program (NAPAP), "Interim Assessment, The Causes and Effects of Acidic Deposition," Volume 3, Emissions and Control, Washington, D.C., 1987.

(4) Lampe, K. and Saarnak, A., "Acid Rain Test," *Farbe + Lack*, 92, 692 (August 1986).

(5) Wolff, G.T., Rodgers, W.R., Collins, D.C., Verma, M.H., and Wong, C.A., *J. Air & Waste Mangae. Assoc.*, 40, 12, 1638, (December 1990).

(6) Cheever, G.D., "Use of Fluorescent Microspray in Studying Solvent Transport in Paint/Substrate Systems I. Sheet Molding Compound (SMC)," JOURNAL OF COATINGS TECHNOLOGY, *60*, No. 762, 61, (1988).

(7) PPG/Chemfil Material Safety Data Sheet, Product CAS No. 27344-41-8, November 5, 1985.

(8) The Microscope Co., Inc., 2411 Medina Rd., Medina, OH 44256.

(9) Wild Leitz USA, Inc., 24 Link Dr., Rockleigh, NJ 07647.

(10) Bauer, D.R., "Degradation of Organic Coatings. I. Hydrolysis of Melamine Formaldehyde/Acrylic Copolymers Films," *J. Appl. Polymer Sci.*, 27, 3651 (1982).

(11) Bauer, D.R. and Briggs, L.M., "IR Spectroscopic Studies of Degradation in Crosslinked Networks," in *Characterization of Highly Crosslinked Polymers*, ACS Symposium Series #243, Labana, S.S. and Dickie, R.A. (Eds.), American Chemical Society, Washington, D.C., pp. 271-284, 1984.

(12) *Acid Rain Information Book*, Second Edition, GCA Corp., GCA Technology Div., Bedford, MA, Dept. of Energy Report, DOE/EP-0018/1, pp. 2-63, May 1983.

(13) Dasch, J.M., "Chemistry of Wintertime Wet Deposition," *The Chemistry of Acid Rain*, Johnson, R.W., Gordon, G.E., Calkins, W., and Elzermann, A.Z. (Eds.), ACS Symposium Series 349, American Chemical Society, Washington, D.C., pp. 242-249, 1987.

Appendix appears on next page.→

APPENDIX A

Definitions

1. Core—The area of greatest damage for a particular exposure.

2. Multiple Cores—The appearance of more than one core as a result of the repeated addition of water.

3. Halo—A uniform ring of secondary damage surrounding the core.

4. Plume—An area of slight damage that resulted from contact of the coating with the acidic fumes from an "acid rain" exposure.

5. Darkening—A condition seen in NAD coatings where there appears to be a loss of the reflectivity of the metal flake.

6. Blackening—A color change associated with damage.

7. Distortion—A visual change in the coating which cannot be removed by wiping but does not involve a noticeable change in color.

8. Deposition—Material deposited on the surface of the coating during the exposure period which can be removed by gentle wiping.

9. Crazing—Many fine shallow cracks, usually confined to the surface of the coating, which are only identifiable using high magnifications (300X or more). See *Figure* A1.

10. Cracking—Discrete large fissures in the coating, usually several microns deep, that are easily observed by visual inspection or at low magnification (50X or less). See *Figure* A2.

11. Blister—A void at the surface of the coating which can be seen at low magnifications (50X). Larger blisters can also be identified from profilometry. (See *Figure* A3).

12. Bubble—A small void developed within the coating which can only be identified at high magnification. See *Figure* 3 in the body of the article.

13. Lifting—A portion of the coating which has physically separated from the bulk of the coating. This is possibly due to the convergence of several blisters. The lifted area also may be cracked and is usually several microns thick.

14. Micro-peeling—A separation of the top 1-3 μm of the surface from the bulk of the coating which can only be identified using high magnification. See *Figure* A4.

15. Residue—The slightly discolored material on the surface of the coating that cannot be removed by gentle wiping and is often associated with a slight etch of the coating.

16. Background—The normal variation in height of the coating as determined from profilometry: 3.5 microns for BC/CC and 3.0 microns for NAD.

17. Raised Area—A portion of the coating higher than the average level of the coating.

18. Etch—An area of the coating where the level in the damaged area is lower than the average level.

19. Edge Effect—A sharp penetration of the coating at the edge of the core which is often the site of maximum penetration into the coating.

Figure A1—Crazing of the surface of the clearcoat. Original magnification: 585X.

Figure A2—Cracking of the clearcoat. Original magnification: 50X.

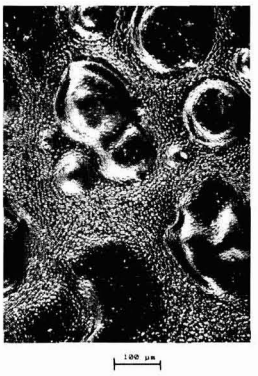


Figure A3—Blisters in the clearcoat. Original magnification: 140X.

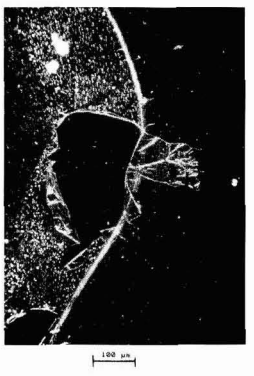


Figure A4—Micro-peeling of the top 1-2 μm of the clearcoat. Original magnification: 140X.

* 1997 Alfred L. Hendry Award Winner *

The purpose of the Southern Society Alfred L. Hendry Memorial Award is to encourage undergraduate college and university students to do work in and author papers in some aspect of coatings technology.

The award consists of $1,000, expenses covering attendance at the FSCT Annual Meeting and International Coatings Expo to receive the award, and a suitably inscribed plaque for the best paper submitted during the award year.

The award was established in 1986, by the Southern Society for Coatings Technology as sponsors, in memory of an honored Past-President of the Society, Alfred L. Hendry.

Evaluation of the Degree of Cure Of a Coating

Kip Sharp and Gerald Mattson—The University of Southern Mississippi*
Sonny Jönsson—Fusion UV Curing Systems†

INTRODUCTION

In the coatings industry, determining when a material has completely cured is important. The standard methods to test for cure are generally well accepted, but the data obtained from these methods is not always reproducible. The research following involves the use of a technique called evaporation rate analysis (ERA) which provides reproducible objective data.

Coating cure is compared using pencil hardness, MEK rubs, and thumb twist test to evaporation rate analysis (ERA). ERA is rated most objective and reproducible.

BACKGROUND

This method was serendipitously discovered nearly 30 years ago while examining a technique to detect contaminants on certain missile fuel storage components.

> "A radioactive material was dissolved in a low boiling solvent and applied with a medicine dropper onto two stainless steel surfaces, one of which had been smeared with grease. The activity of the surfaces was determined with a thin end-window Geiger counter. It was expected that a greased surface would exhibit lower activity resulting from attenuation of the 'soft' beta emissions... The observed results were quite different. The contaminated surface had higher activity then the 'clean' surface. The radioactive material chosen was volatile and had evaporated from the 'clean' surface. The vapor pressure had been lowered by the grease causing retention of the labeled material."

The observations from this experiment resulted in the application of ERA as a method of testing the cure of a coating.[1]

Evaporation rate analysis focuses on the surface of the coating. The method involves the use of a low boiling point solvent in combination with a higher boiling point C-14 labeled material. The C-14 compound must still be completely volatile for the process to work properly. A known amount of solvent containing the C-14 labeled compound is placed on the surface of the coating to be tested. Air is blown at a constant rate over the mixture allowing the solvent to evaporate[2]; as this occurs a thin end-window Geiger counter above the sample detects β-radiation given off by the C-14 labeled compound[1] (see *Figure* 1). The rate at which the labeled material evaporates can then be plotted as a function of time to give an indication of the surface crosslink density. If the sample is uncured, the solvent along with the C-14 material will diffuse into the coating and continue to be detected by the Geiger counter over a longer period of time (see *Figure* 2). A cured coating has a higher crosslink density which would restrict the solvent mixture from penetrating into the coating (see *Figure* 3). The labeled material would therefore evaporate off more rapidly causing the counts recorded by the Geiger counter to correspondingly decrease.

The rate depends on several factors which yield information about the coating. "Typical surface phenomena affecting evaporation rates include: roughness, surface area, porosity, molecular discontinuities, chemical composition, and structure."[2] "Many of the present methods relating surface hardness, abrasion, and staining to extent of cure or crosslinking were found to be unsuitable for evaluating very thin films."[3] Those tests could not give a direct reading of the crosslinking. ERA, however, can correlate the surface interactions to the degree of crosslinking which in turn determines the degree of cure.[3]

*Department of Polymer Science, Hattiesburg, MS.
†Rockville, MD.

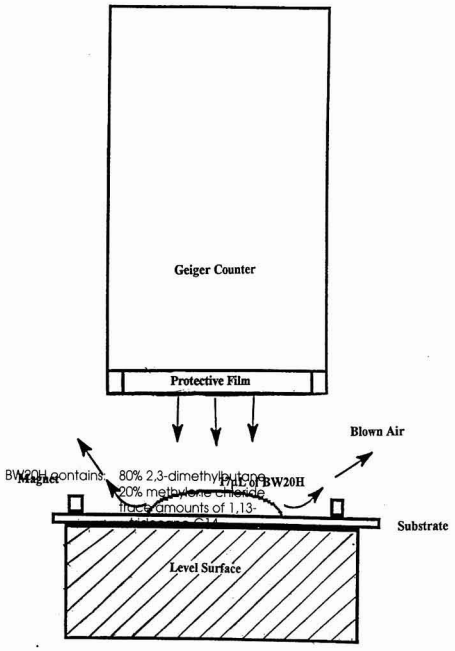


Figure 1—Illustration of radiation detector

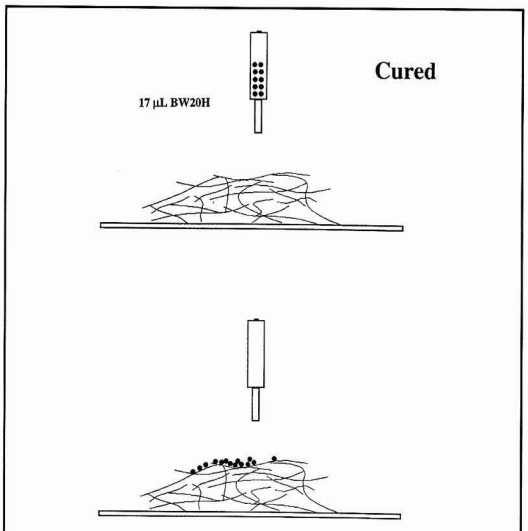


Figure 3—Illustration of solvent and cured sample interaction.

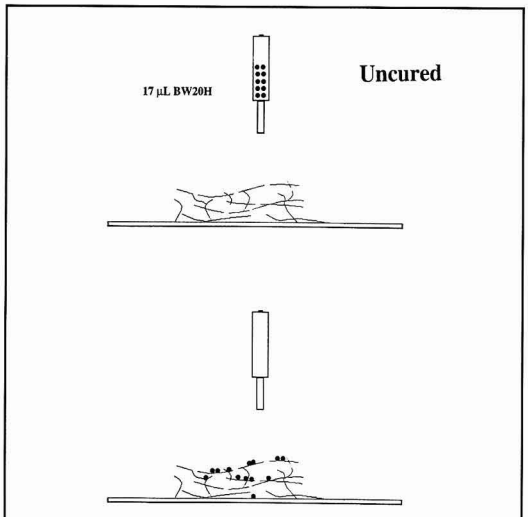


Figure 2—Illustration of solvent and uncured sample interaction.

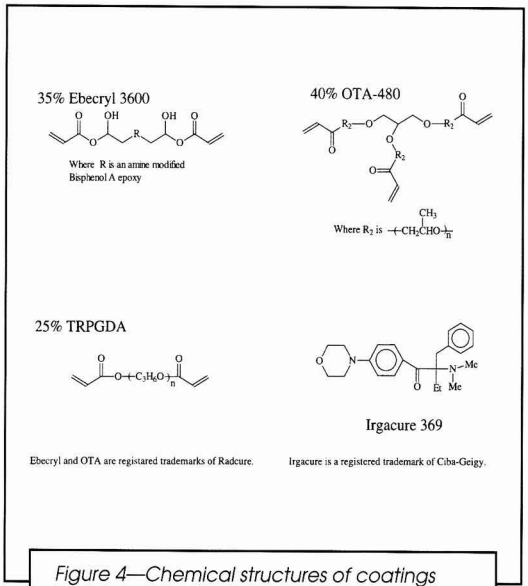


Figure 4—Chemical structures of coatings resins and photoinitiator.

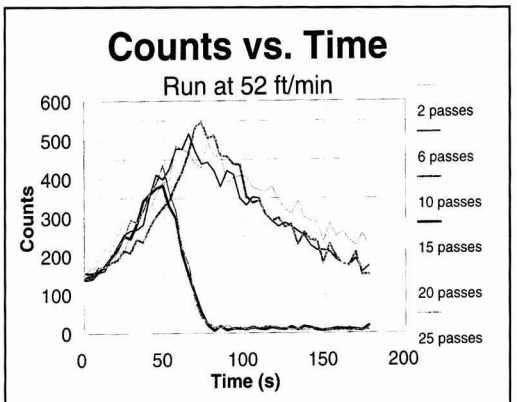


Figure 5—Trial to approximate number of passes required to cure sample

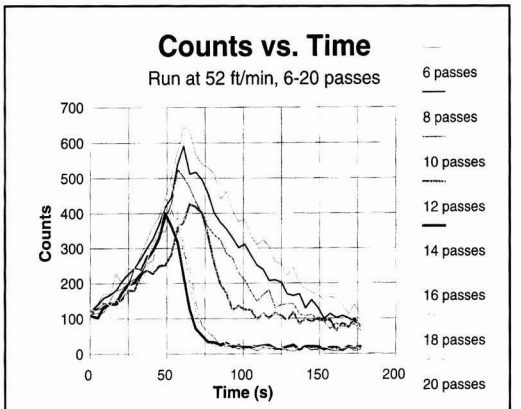


Figure 6—Trial to pinpoint number of passes required to cure sample.

EXPERIMENTAL

The samples tested by the cure testing methods consisted of a UV curable coating mixture containing 25% (weight percentage) Ebercryl® 3600 resin (diacrylate ester of a bisphenol A-type epoxy resin), 35% TRPGDA (tripropylene glycol diacrylate), 40% OTA-480 (propoxylated gycerol triacrylate), and 1% photoinitiator. Ebercryl 3600 is the pre-polymer. TRPGDA and OTA-480 are diluents which promote crosslinking and also reduce with the high viscosity of the pre-polymer. When polymerized, these materials combine to form a high gloss overprint coating. Igracure® 369 was utilized as the photoinitiator throughout this study (see *Figure* 4).

Dealing with equipment and chemicals, especially radioactive compounds, requires special attention to safety. The Material Safety Data Sheets (MSDS) were reviewed prior to use of any of the chemicals to examine possible health hazards. Skin irritations caused by the TRPGDA and the OTA-480 and possible injury to the eyes or skin from UV radiation prompted the use of gloves, a lab coat, and safety glasses at all times while dealing with any of the aforementioned. Safety glasses with UV protection were worn while using the Fusion® belt system which itself has built in UV and microwave shielding to minimize exposure to the operator. Emphasis was placed on handling and using the ERA solvent mixture due to the radioactive component; although the β-radiation emitted by the compound is extremely low and is exempt from special procedures from the U.S. Nuclear Regulatory Commission or OSHA.

The UV curable high gloss overprint varnish components minus the photoinitiator were weighed out and mixed in a sonicator. A one percent by weight concentration of Igracure 369 was then added to the mixture, and again it was sonicated. A small amount of the mixture was put into a strip of special paper (called a penetration chart) procured from Paul N. Gardner Company, Inc. (Gardner Form HK). A Gardner's Universal blade applicator was used to spread the coating mixture over the paper at three mils average thickness. Next, the coating was exposed to the UV light generated by the Fusion medium pressure mercury lamp with a Fusion belt system until the desired number of passes for each sample had been made. The belt speed was maintained at 52 ft/min.

Besides evaporation rate analysis, three other cure analysis tests were performed on each sample for comparison. The least objective of the three cure tests was the thumb twist test. After each pass the coating was checked to see if the curing was complete by using the thumb twist test. This technique involves the operator placing his/her protected thumb on the coating and twisting it 90°. If no finger imprint was observed on the coating, the coating was considered cured at that point. Other areas of the coating were tested using the pencil hardness test and the MEK (methyl ethyl ketone) double rub test. The pencil hardness test uses 14 different pencils with varying graphite hardness (6H being the hardest to 6B being the softest) to measure the hardness of coating. Starting with the softest, the 6B pencil is pushed forward across the coating a 45° angle with even pressure. If the film is not ruptured or scratched, the next harder pencil is tried until it ruptures or passes all 14 pencils.[5] The MEK rub test involves taking a two-pound ball peen hammer and using the ball end covered in cheese cloth, which is periodically soaked by MEK, to rub up and down (a double rub) across the coating. The rubbing is stopped if the film is penetrated, the coating is removed, or after 200 double rubs if the sample has not changed in appearance and in gloss.[6] Next, the coating was tested using ERA which only required a small area of the sample and 17μL of the special solvent. The sample was placed in the testing apparatus and the solvent was then placed on the surface of the coating. The thin window Geiger counter was positioned over the testing area, and then air was blown over the sample for 180 sec. The data was then analyzed using a special computer software package.

RESULTS AND DISCUSSION

A variety of different trials were made to examine and compare ERA to the other three methods. The experiments had to be made over a wide range of passes since the cure time had not been determined by ERA previously (see *Figure* 5). To pinpoint the exact number of passes required to achieve cure, a second set of trials was performed (see *Figure* 6). The number of passes determined by ERA for this particular sample to achieve complete cure was 14. The thumb twist test gave a variety of the passes at which the coating was cured depending on the amount of pressure applied, the operator, etc. The thumb twist test proved difficult to reproduce even if performed by the same person. The pencil hardness test indicated that the sample was cured after 11 or 12 passes as compared to a standard of the coating. While the MEK double rub test indicated the sample was cured after 12-16 passes depending on the trial. The correlation between outdoor performance and the number of passes through exposure has not yet been performed.

CONCLUSIONS

The thumb twist test proved to be by far the most subjective test. While the pencil hardness was more objective, the operator's force on the pencil can result in variation. Differences in the operator, in applied pressure, in the amount of solvent, and when penetration is observed can result in variation with the MEK double rub test as well, yet if the test procedure is followed the results are more reasonably objective. The thumb twist, the pencil hardness, and the MEK double rub tests require a larger sample size to evaluate the degree of cure. ERA requires only the area taken up by 17μL drop of solvent, and the differences between operators has no effect on the reproducibility of the data. Different coating systems, however, may require different solvents to perform the test.[7] The four cure test methods were each useful in determining cure, but evaporation rate analysis proved to the most objective, least destructive, and most reproducible of the four.

ACKNOWLEDGMENT

MESERAN Co., Southern Society for Coatings Technology, Fusion UV Curing Systems, UCB Radcure, Ciba-Geigy, First Chemical Corp., Dr. Roger McCartney, R. Nagarajan, Dr. Charles E. Hoyle, Chris Miller, Jim Owens, Shan Clark, Garrett Doucet, and the rest of the Hoyle Research Group.

References

(1) Anderson, J.L., "Introduction to Evaporation Rate Analysis," *Organic and Plastics Chemistry*, 29, No. 2, 250-1 (1969).
(2) Wegman, Raymond F. and Otzinger, M.C., "A Study of Adhesive Joint Failures by Evaporation Rate Analysis," *Organic and Plastics Chemistry*, 29, No. 2, 265 (1969).
(3) Rossi, A.G., Charland, G.A., and Stammer, W.C., "Determining the Cure Parameters of Coatings by Evaporation Rate Analysis," *Organic and Plastics Chemistry*, 29, No. 2, 308 (1969).
(4) Moss, E.C., "Radiation Hazards Associated with Ultraviolet Radiation Curing Processes—An Update," *Radiation Curing*, May (1985).
(5) Gaynes, N.I., *Testing Organic Coatings*, Noyes Data Corporation, Park Ridge, NJ, 1977, 88.
(6) Powder Coatings Institute, 1800 Diagonal Rd., Ste. 370, Alexandria, VA 22314, phone: (703) 684-1770.
(7) Helwig, E.J., "Determination of Cure of Lacquers on Tinplate," *Organic and Plastics Chemistry*, 29, No. 2, 302 (1969).

OPEN FORUM

When Disaster Strikes . . .

Neil R. Shearer—Andek Corporation, Moorestown, NJ.*

On a Thursday afternoon, 4:15 p.m., June 15, 1995, a strange event took place that dramatically changed our company and affected not only us but everyone around us. We had manufactured the same formula of aluminum paint for over 12 years without any significant problems. That afternoon, however, 30 min after pumping the aluminum paste into the mixing tank, a thick fog was observed in the factory. Our accounts manager, Millard Klein, drew this to my attention. In less than three minutes, visibility was zero and the smoke alarms went off. Back in the office, many people were on the phone, trying to ignore the interruption of the alarm bells, since they were unaware of the problem next door. After being convinced that this time it was "the real thing," everyone evacuated the building as we had all practiced before, and assembled on the front lawn.

The general manager, Tom Taylor, and myself had just closed the doors to the warehouse and were about to join the others at the assembly point when the first explosion occurred. It was not what one would have expected. Instead of a loud bang, it was a tremendously loud click as all of the masonry blocks impacted with the driveway as one wall blew out. We decided to escape in our cars, reasoning that the roofs would act as shields against falling debris. We raced out with our cars in reverse (having parked nose inwards) and joined the others at the assembly point, just in time to watch the second explosion. This one took the roof about 40 feet into the air, then quite as suddenly sucked the flying debris back into the factory.

The fire brigade arrived as the massive wall of flames in front of the factory had spread to the labs and the office. The main priority now was to save the warehouse. As we watched the inferno consume the mixers, pumps, walls, filing cabinets, desks and everything else, Tom voiced a question what was probably on everyone's minds. "Is this the end of the company, will we still have our jobs tomorrow?" Harry Liss, President of the company, replied without hesitation, "This is not going to put us out of business, we will rebuild." This was reassuring, although at that point watching the flames, the fire engines, and the circling news helicopters, it seemed highly unlikely.

By 10:00 p.m., the last glowing embers were doused and the warehouse was safe. It was dark, and we decided to go home and check the damage the next day. That morning, daylight revealed the extent of the devastation. Only one wall remained of the factory. Melted roof beams were draped like limp spaghetti across the blackened mixers. The factory clock has been hurled across the yard, probably by the first explosion. It was stopped at 4:27 p.m.; 12 minutes was all the time it took between the discovery of a problem and our successful escape. The fireproof safe revealed a disappointment. Our backup floppy disks had melted in the heat, with all of our papers burned also. We had no records of our customers and suppliers, which of them had accounts receivable or payable —we had no other backup system.

That Friday brought us many visitors, O.S.H.A., E.P.A., the insurance company, the department of emergency response, and several members of the Philadelphia Society for Coatings Technology. One of these visitors loaned me their copy of the FSCT Yearbook, which was to become a tremendously useful tool for the rebuilding of the company. All of our suppliers' names, addresses and phone numbers were listed. This enabled us to phone them and reassure them that we planned to remain in business and that, if we had accounts payable, they would be dealt with. This news, spread through the industry in our area, preceded our next inquiries.

Through attending meetings of the Philadelphia Society for Coatings Technology for several years, I had socialized with all the major coatings manufacturers in the area. This familiarity helped when we began to inquire amongst them as to whether they had any spare manufacturing capacity, since our own factory was completely destroyed and we only had enough inventory in our warehouse to make it through one month of orders. Unless we could get back into production, we were definitely going to be out of business. Certainly, Society connections at the PSCT helped a lot, but it was still what one might call "a tough sell." The typical response was, "So, you want me to make these products in my factory, right; but your factory was making these products until recently and is now a blackened heap, right? So, is my factory next?"

Fire investigators had, by this time, determined the cause of the problem. The diaphragm in the pump had ruptured, allowing condensate from the compressor to mix with the aluminum paste in the transfer hose to initiate the reaction in the tank. Water and aluminum paste had reacted together to form hydrogen gas that eventually created an explosive mixture with the air. O.S.H.A. agreed that we had been following every safe practice. The previous year, we had earned a bronze star in their A.C.T. program and were hoping for a silver star for 1995. They concluded that this is what is known technically as a "highly unusual event." This reassured us as well as our prospective manufacturers, and we soon had arrangements in place to begin production.

Our sales staff had meanwhile managed to contact most of our customers using memory and luck. Orders were coming in and, with production back on line, we were definitely in business. At the next meeting of the Philadelphia Society for Coatings Technology, I was greeted quite enthusiastically. The choice of that night's presentation seemed somewhat *apropos*—"The Use of Oxazolidines as Moisture Scavengers," a coincidence probably.

Many people over the last two years have asked, "Have you rebuilt yet?" There is no clear answer to this. We survived a disaster that seven out of ten coating manufacturers do not. We are solidly in business now, but are not the same company we were before June 15, 1995. Our experience, we believe, has helped us to become more efficient and has caused us to rebuild only the useful parts of the old company and, just as fire stimulates new growth in a forest, so our rebuilding has created a new company.

We are very grateful to all the people who helped us through our darkest days. We hope to share the benefits of our gained knowledge through the community of the industry made possible by the Federation of Societies for Coatings Technology.

P.O. Box 392, Moorestown, NJ 08057.

Dual Drive Coaxial Dispersers

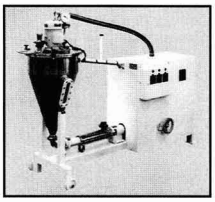
SCHOLD MACHINE CO.

Schold dual drive, dual motor, VHLS coaxial dispersers are designed for mixing and dispersing products with high viscosities in excess of 1,000,000 C.P.S. This disperser combines a slow-speed, high-torque blade with a high-speed, high-shear blade in a coaxial position. The nominal speed range of the slow-speed blade is 20 to 155 RPM, while the range of the high-speed blade is 400 to 2,000 RPM. Product range capabilities include inks, caulks, flush pigments, paints, dyestuffs, epoxies, texturizing compounds, putties, adhesives, and resins.

Circle No. 60 on Reader Service Card

Vacuum Deaerator

FRYMA, INC.

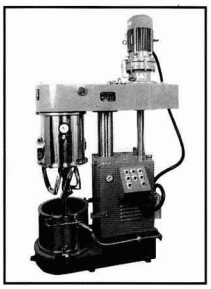


The Fryma vacuum deaerator removes gas that has been worked into a product during processing by passing the liquid through a screen on the outside of a rotating disc. The centrifugal force causes the product to be sprayed through the screened disc, and the vacuum in the vessel causes the bubbles to expand and burst. The released gas is sucked out of the vessel by the vacuum pump.

Circle No. 61 on Reader Service Card

Triple Arm Planetary Mixer

INOUE USA, INC.

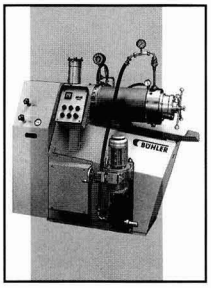


Inoue USA Inc. has announced the availability of the Tri-Mix, a triple arm planetary mixer. The mixer consists of three open frame patented blades that rotate in planetary orbit. The material viscosity range is 10,000 cps to 1,000,000 cps. If a vacuum hood and mechanical seal are used, the product can be operated under vacuum and decompressed conditions for low-temperature boiling, defoaming, and dehydration. Hood and seal are standard equipment on various models.

Circle No. 62 on Reader Service Card

High Capacity Bead Mill

BUHLER INC.



A new high capacity bead mill that uses ceramic materials to disperse and grind low to medium viscosity, aqueous, and solvent-based products has been introduced by Buhler Inc. The BOA 125/251 HS features a built-in motor with low noise power transmission with antistatic V-belts. Applications include automotive and industrial paints, printing inks, wood paints, building paints and varnishes, color pastes for plastics, textile dispersions, etc.

Circle No. 63 on Reader Service Card

DM-55BAS/A Mixer

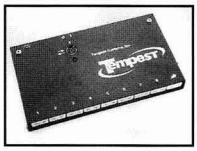
DRUM-MATES® INC. DRUM MIXER & PUMP DIV.

Drum-Mates® Inc., Drum Mixer & Pump Div., manufactures and supplies bung entry drum mixers and mixer rinse tubes, drum rollers and tumblers, bung thread adapters, drum pumps, and dispensing nozzles. The DM-55BAS/A mixer (pictured) has four tiers of blades that mix the top, middle, and bottom simultaneously. The mixer creates a large columnar fluid flow even at very low rpm. It will easily handle paint with impacted, clay-like bottom sediments using vigorous agitation at high speed.

Circle No. 64 on Reader Service Card

Tempest Data Logging System

TANGENT SYSTEMS, INC.

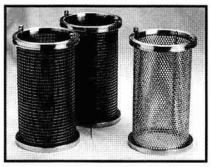


The Tempest System, available from Tangent Systems, Inc., provides an alternative to in-process temperature profiling. The components allow users to match the data logger, sensors and thermal enclosure best suited to the process being analyzed. Windows™-based software provides graphing and report tools. All internal memory is non-volatile RAM. Thermal enclosures provide protection from processing conditions.

Circle No. 65 on Reader Service Card

DCF Clean-In-Place Filters

RONNINGEN-PETTER



The DCF series of clean-in-place liquid filters now feature permanent perforated media for strainer applications. Permanent media reportedly reduces downtime, waste disposal, and media replacement costs versus disposable media. Three sizes of perforations are available for media retentions of 1550, 3125, or 6250 microns (.062", .125", or .250") Available from Ronningen-Petter, DCF filters also come with a vertically slotted wedge wire screen for filtration to 15 microns.

Circle No. 66 on Reader Service Card

Laboratory High-Speed Disperser

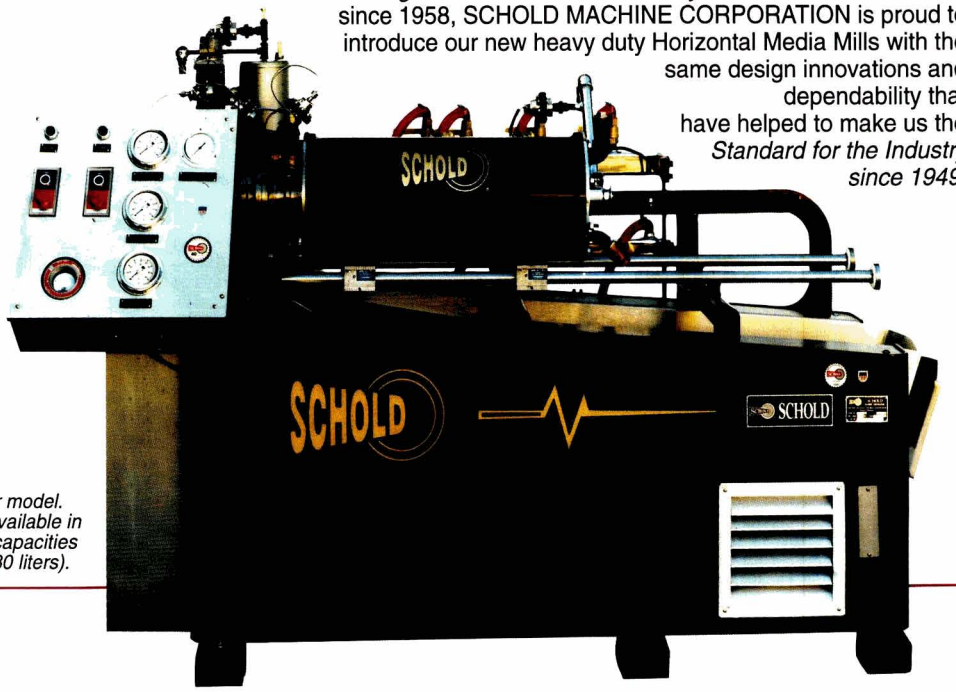
EIGER MACHINERY, INC.

Designed for batches of 250 ml-50 liters, Eiger Machinery, Inc. has introduced the laboratory/pilot disperser. This flexible laboratory machine can be used as a high-speed disperser, low-speed mixer, rotor stator mixer, or optional batch bead mill vessel with agitator. It is recommended for small to medium size batches that require consistent processing of liquid and paste viscosity materials.

Circle No. 67 on Reader Service Card

NEW FROM SCHOLD®
HORIZONTAL MEDIA MILLS

The *originators of the shot mill* and your source for media mills since 1958, SCHOLD MACHINE CORPORATION is proud to introduce our new heavy duty Horizontal Media Mills with the same design innovations and dependability that have helped to make us the *Standard for the Industry since 1949.*



56 liter model. Also available in other capacities (1/2-280 liters).

All Schold Horizontal Media Mills Come Complete With:

- Rotary Screen with Carbide Gap
- SS Alloy Discs
- Pressurized Shaft Seals
- Media Discharge Tray
- Zoned Chamber Cooling
- Sliding Chamber
- 10 Gallon Flushout Funnel Mounted to Variable Speed Gear Feed Pump
- Media Washout Trough
- Tool Kit
- All Safety Features

Safety Features

- Low Barrier Fluid Shutoff
- Low Barrier Fluid Pressure Shutoff
- High Temperature Shutoff
- High Pressure Shutoff
- Motor High Temperature Shutoff

ALL HORIZONTAL MEDIA MILLS ARE *NOT* ALIKE
Experience the Schold Difference

SCHOLD MACHINE CO.

Precision Dispersion Equipment Since 1949

Two Complete Test Labs For Your Convenience

Southern Facility
10590 Oak Street N.E., St. Petersburg, FL 33716-3327
Tel: 813-576-1147 • Fax: 813-579-1806
Sales, Technical & Safety Hotline: 1-800-RGD-MIXR

Midwest Facility
7201 West 64th Place, Chicago, IL 60638-4692
Tel: 708-458-3788 or 458-3793 • Fax: 708-458-3866
Sales, Technical & Safety Hotline: 1-800-4MIXERS

Schold Research & Development, Inc.
Tel: 813-576-1132 • 708-458-3793

Circle No. 252 on the Reader Service Card

High Vacuum Cauge Controller

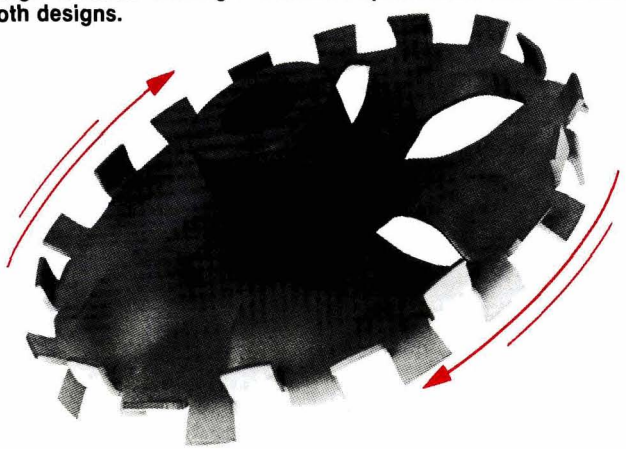
MKS INSTRUMENTS, HPS DIVISION

HPS has modified the SensaVac™ Series 919 Hot Cathode Gauge Controller. The controller now includes the units of measure on the display panel, and the switches have been modified for easier use. The 919 measures vacuum pressure from 10^{-10} to 10^{-2} Torr. The controller features an LED display with a choice of Torr, Pascal, or mbar readout. The systems includes analog output, two setpoints, remote sensor enable/disable, and sensor filament protection.

Circle No. 68 on Reader Service Card

THE CONN BLADE®

Patented intensive type blending/dispersing blades with unique design features making a radical improvement over old saw tooth designs.



- ★ **Most efficient and aggressive blending/dispersing blade available.**
- ★ **Provides proper combination of pumping action and shear/dispersion essential for fast and consistent results.**
- ★ **Built in pumping action for material turnover can cut processing time 30 to 40%.**
- ★ **Blades last much longer due to heavier gauge construction and shorter required running time.**
- ★ **Puts less heat into product.**
- ★ **Excellent for high or low speed and high or low viscosity.**
- ★ **Supplied with hubs or mounting holes required to retrofit and upgrade present equipment.**
- ★ **Pumping blades without teeth are available and are excellent for more gentle blending and agitation.**

DESIGNERS AND MANUFACTURERS OF INDUSTRIAL MIXING EQUIPMENT

Since 1948
CONN AND CO.
"We Keep Things Mixed Up"

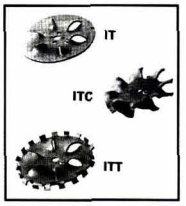
Stirrers Or Complete Units For:
PAINTS, ADHESIVES, INKS, CEMENTS, URETHANE FOAMS, SLURRIES, GROUTS, ETC. . . .

11 SOUTH MARION STREET • WARREN, PENNA. 16365 • PHONE 814/723-7980
FAX (814) 723-8502

Circle No. 141 on the Reader Service Card

Industrial Mixing Equipment

CONN AND CO.

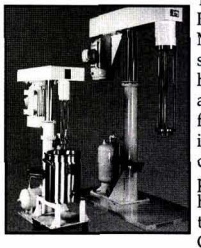


Conn and Co. designs and manufactures industrial mixing equipment. The company has introduced three patented blades under the tradename Conn Blade®. The ITT style features a combination of louvers and teeth. The IT has louvers for gentle mixing for shear-sensitive materials. The ITC is an eight-vane, open style blade that proves more shear than the IT while allowing material flow. Conn Blades reportedly attain results in a shorter time with less heat generated.

Circle No. 69 on Reader Service Card

PreMax Rotor/Stator Mixer

CHARLES ROSS & SON CO.



The PreMax Rotor/Stator Mixer, designed as a high-speed alternative for pre-mixing prior to down stream processing, has been introduced by Charles Ross & Son Co. Pre-Max results in dispersions that reportedly measure between five and seven on the Hegman Gauge. Models range from a two-inch rotor/stator diameter with a 5-20 gallon capacity, to a 20 in. diameter and 500-1,000 gallon capacity.

Circle No. 70 on Reader Service Card

Drum Labeler

PIONEER PACKAGING MACHINERY

The new PF-97 Pioneer Pail Labeler is now being offered for 55-gallon drums. Available from Pioneer Packaging Machinery Inc., this product features a label gate design for placing larger paper, or pressure sensitive labels onto all types of drums automatically. The labels can be printed by a thermal printer on the production line.

Circle No. 71 on Reader Service Card

Rapid Circulation Milling

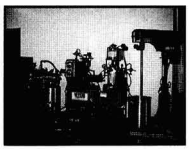
HOCKMEYER EQUIPMENT CORP.

Hockmeyer has introduced new immersion milling technology based on the latest designs of basket mill. These designs utilize the right mix of horsepower, basket volume, peg layout, and impeller efficiency. The HCPs (counter peg design) uses up to three horsepower per liter of media and generates a uniformity in particle distribution and size. The HCP allows the removal of the counter insert to address more shear and impact sensitive products.

Circle No. 72 on Reader Service Card

Used Production and Lab Equipment

WESTERN EQUIPMENT CO.



Western Equipment Co. provides used laboratory and production equipment to the coatings industry. The company's inventory consists of high speed dispersers, mills, label and filling machines, laboratory mixers, and physical testing equipment. A complete catalog is available at www.westernequipco.com.

Circle No. 73 on Reader Service Card

Anti-Static Process Tank Cover

HENDEE ENTERPRISES

Hendee's anti-static tank cover is a .004 mil anti-static drip cover for the tote type tank. Since tote tanks become coated with dried paint as a result of testing and filling, these tank covers fit over the tote and catch the paint that would normally end up on the outside of the container. The covers go on the tanks before filling, stay on during usage, and keep the container clean throughout the entire process.

Circle No. 74 on Reader Service Card

Bag Handling System

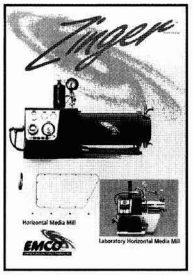
ANVER CORP.

A fully integrated vacuum and hoist bag handling system that allows workers to slit and empty bags over hoppers has been introduced by Anver Corp. The Anver VB-4 Bag Handling System is available in 250-, 500-, and 1,000 lb. capacity models and requires 28 in. of operating head room. Standard features include up/down fingertip controls, quick-disconnect vacuum pad attachments, and a power station that can be located up to 250 ft. away.

Circle No. 75 on Reader Service Card

Horizontal Media Mill

EMCO USA

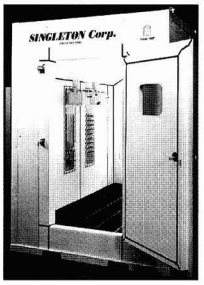


The new Zinger™ horizontal media mill from EMCO USA features proprietary design and technology. This product's radial rotor vanes draw media/product to the chamber center then mechanically force it outward producing less rotor/product slippage and using more shear energy in dispersion. Flow-direction control bars on the inside chamber surface rapidly decelerate and evenly disperse the media/product.

Circle No. 76 on Reader Service Card

Cyclic Corrosion Test Chamber

SINGLETON CORP.

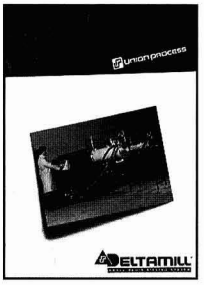


The newly molded fiberglass cyclic corrosion test chamber from Singleton Corp. cycles between salt fog, dry, humidity, and ambient temperature cycles automatically. An optional humidity control feature is available for performing new automotive test methods. A touch-screen operator interface displays temperature and humidity set points, operating temperatures, cycle times, and counts.

Circle No. 77 on Reader Service Card

Deltamill™ Small Media Milling System

UNION PROCESS, INC.



A revised brochure on the Deltamill™ Small Media Milling System is now available from Union Process. The updated publication features a schematic engineering drawing that depicts the cross-section view of the Deltamill. Dimensional drawings, coupled with an engineering data chart with specifics about this product are also included. The Deltamill can reportedly utilize media as small as 0.25 mm in diameter.

Circle No. 78 on Reader Service Card

Asphalt Mixer

SILVERSON MACHINES

Silverson has developed an in-line mixer specifically for high-temperature disintegration and solubilization of polymers into asphalts. The mixer's high speed rotor/stator workhead rapidly provides complete solution of polymers such as SBS, APP, PVC, and EVA to produce modified asphalts for the road surfacing and roofing industries.

Circle No. 79 on Reader Service Card

FSCT Membership

Offers The Right Mixture for Success

PUBLICATIONS

- A **Complimentary subscription** to the *Journal of Coatings Technology* is included with your membership dues. The JCT, published monthly, is respected around the world for the quality of its technical information. Each issue features papers on the cutting edge of technology, as well as information covering regulatory updates, people in the news, new products, etc.
- The Year Book, the **Who's Who in the Coatings Industry** provides names, addresses, phone and fax numbers of over 7,400 coatings professionals. Included with dues, the spiral-bound desk reference lists FSCT's 27 Constituent Societies and Affiliated members. (a $150 value)
- FSCT's reference materials including the *Coatings Encyclopedic Dictionary, SciQuest,* and the *Series on Coatings Technology* are available to members at discounted prices - you can **save up to 25%** .

EDUCATIONAL PROGRAMS

- Gain **useful ideas and methods** to implement on the job by attending FSCT's regional seminars.
- Network with industry peers at the **FSCT Technology Conference** featuring training sessions and courses for both veterans and beginners in the coatings industry.
- Evaluate the newest trends in technology at the **International Coatings Expo (ICE)**. Held in conjunction with the Technology Conference, the Expo is the largest international trade show for the coatings industry.
- Receive **mailings on FSCT programs**, including updates on the ICE and other FSCT- sponsored events.

SERVICES

- Further your **leadership skills** by serving on Society/FSCT Committees.
- **Save over 25% on registration rates** when attending the FSCT International Coatings Expo and Technology Conference.
- Obtain discounted travel rates through the **FSCT Travel Desk** by calling 800-448-FSCT or 215-628-2549.
- Request information from FSCT's Fax on Demand Service by calling 800-838-5445. International callers please use 215-953-7893.

JOURNAL OF COATINGS TECHNOLOGY

For more information contact:
FSCT Membership Services
492 Norristown Rd.
Blue Bell, PA 19422-2350
(610) 940-0777 Phone
(610) 940-0292 FAX
http://www.coatingstech.org

ice INTERNATIONAL COATINGS EXPO

October 14-16, 1998
New Orleans, LA

Regulatory Update

Federal Regulations
State Regulations
International Activity
Update Analysis

February 1998

This summary of current regulatory activity of interest to the coatings industry is published to inform readers of actions that could affect them and their firms, and is designed to provide sufficient data to enable those interested to seek further information. Material is supplied by the law firm of Swidler & Berlin, Chartered, in Washington, D.C. Although reasonable steps have been taken to ensure the reliability of this Regulatory Update, the FSCT and Swidler & Berlin cannot guarantee its completeness or accuracy.

Federal Regulations

Occupational Safety and Health Administration
December 18, 1997 - 62 FR 66275
Action: Partial stay of start-up dates for compliance with final rule
Subject: Delay in deadline for applicability of methylene chloride exposure standard

OSHA is delaying the deadline to comply with certain portions of its final methylene chloride occupational exposure standard, published in the *Federal Register* January 10, 1997 (62 FR 1494). It is taking this action in response to a joint labor-industry motion for reconsideration of certain provisions of its final standard. The compliance delay applies to companies in the construction, foam manufacturing, furniture stripping, product formulation, and small aircraft stripping industries, and to those companies which use adhesives containing methylene chloride for foam fabrication, boat and recreational vehicle manufacture, upholstery, and van conversion.

Companies in these sectors have until August 31, 1998 to comply with respiratory protection requirements and until December 10, 1998 to install required engineering controls.

For more information, contact Bonnie Friedman, Director, OSHA Office of Public Affairs, Room N-3647, U.S. Department of Labor, 200 Constitution Ave., N.W., Washington, D.C. 20210, phone: (202) 219-8151.

Environmental Protection Agency
December 23, 1997 - 62 FR 66998
Action: Final Rule
Subject: Approval of changes in Bay Area Air Quality rules regarding parts and products coating

Effective January 22, 1998, EPA is finalizing the approval of revisions to the California State Implementation Plan (SIP) proposed in the *Federal Register* on August 4, 1997. The revisions incorporate into the federally approved SIP certain rules of the Bay Area Air Quality Management District (BAAQMD) with updated definitions, including a revised definition of VOC and exempt compounds. The approved BAAQMD rules include those for: general solvent and surface coating operations; metal container, closure and coil coating; paper, fabric and film coating; surface coating of large appliance and metal furniture; surface coating of miscellaneous metal parts and products; graphic arts printing and coating; coating of flat wood paneling and wood flat stock; aerospace assembly and component coating operations; surface coating of plastic parts and products; wood products; surface coating of marine vessels; motor vehicle and mobile equipment coating operations; and polyester resin operations.

For further information, contact Christine Vineyard, Rulemaking Office (AIR-4), Air Division, U.S. Environmental Protection Agency, Region IX, 75 Hawthorne St., San Francisco, CA 94105, phone: (415) 744-1197.

Environmental Protection Agency
December 23, 1997 - 62 FR 67002
Action: Direct Final Rule
Subject: Approval of Mojave Desert Air Quality rule regarding VOC emissions from metal parts and products coating operations

U.S. EPA is taking direct final action to approve a revision to the California SIP. The revision will incorporate into the federally approved SIP Rule 1115 of the Mojave Desert Air Quality Management District (MDAQMD), which controls VOC emissions from metal parts and products coating operations. The approval will become effective on February 23, 1998, unless adverse or critical comments are received by January 22, 1998, in which case the effective date will be delayed while the Agency reviews and responds to such comments.

For further information, contact Jerald S. Wamsley, Rulemaking Office, AIR-4, Air Division, U.S. EPA, Region IX, 75 Hawthorne St., San Francisco, CA 94105, phone: (415) 744-1226.

Environmental Protection Agency
December 23, 1997 - 62 FR 67004
Action: Final Rule
Subject: Approval of revisions to New York SIP for control of VOC emissions

Effective January 22, 1998, U.S. EPA is finalizing the approval of revisions to the New York SIP proposed in the *Federal Register* on May 24, 1995. The revisions incorporate into the federally approved SIP amendments to several state regulations, including Part 200, General Provisions; Part 201, Permits and Certificates; Part 228, Surface Coating Processes; Part 229, Petroleum and Volatile Organic Liquid Storage; and Part 234, Graphic Arts. The amendments extend reasonably available control technology (RACT) rules to enlarged nonattainment areas and to all of New York State which is part of the Northeast Ozone Transport Region. Also, the amendments to Part 228 regarding Surface Coating Processes correct deficiencies in New York's existing SIP, as required by the Clean Air Act.

For further information, contact Paul R. Truchan, Air Programs Branch, 290 Broadway, 25th Floor, New York, NY 10278, phone: (212) 637-4249.

Environmental Protection Agency
December 23, 1997 - 62 FR 67009
Action: Withdrawal of Direct Final Rule
Subject: Ambient air quality surveillance for lead

On November 5, 1997, U.S. EPA published a direct final rule on ambient air quality surveillance for lead (62 FR 59813). At that time, the Agency stated that if any adverse or critical comments were received by December 5, 1997, it would delay the effective date of the rule. Since EPA has received such adverse comments, it is withdrawing the direct final rule and will address the comments received in a subsequent final action in the near future. The direct final rule had called for a substantial reduction of roadside lead monitors and an increase in the number of monitors near stationary lead sources such as smelters and battery-manufacturing plants. The adverse comments received were from industry groups opposed to the shift toward stationary source monitoring and away from mobile source monitoring. EPA has not called for further comment on the rule.

For further information, contact Brenda Millar, Emissions, Monitoring, and Analysis Division (MD-14), Office of Air Quality Planning and Standards, U.S. EPA, Research Triangle Park, NC 27711, phone: (919) 541-4036; e-mail: millar.brenda@emai.epa.gov.

Environmental Protection Agency
January 6, 1998 - 63 FR 640
Action: Final Rule
Subject: Amendments to list of regulated substances and thresholds for accidental release prevention

The U.S. EPA is modifying the rule listing regulated substances and threshold quantities under section 112(r) of the Clean Air Act, Prevention of Accidental Releases. EPA is deleting the category of Division 1.1 high explosives (as listed by the Department of Transportation (DOT)) from the regulated substances list in order to avoid regulatory duplication, as explosives are currently regulated by the DOT and other federal, state and local agencies. In addition to this delisting, regulated flammable substances in gasoline and in naturally occurring hydrocarbon mixtures prior to initial processing are exempted from threshold quantity determinations, and the provision for threshold determination of flammable substances in a mixture is clarified. The definition of stationary source is modified to clarify the exemption of transportation (and incident storage) and to clarify that naturally occurring hydrocarbon reservoirs are not stationary sources or parts of stationary sources. EPA is making these changes to better focus accident prevention activities on stationary sources with high hazard operations, as the Agency does not consider these substances to pose a particularly high risk. The rule became effective Jan. 6, 1998.

For further information, contact Vanessa Rodriguez, Chemical Engineer, Chemical Emergency Preparedness and Prevention Office, U.S. EPA, MC-5101, 401 M St. SW, Washington, D.C. 20460, phone: (202) 260-7913; or contact the Emergency Planning and Community Right-to-Know Hotline at 1-800-424-9346.

Occupational Safety and Health Administration
January 8, 1998 - 63 FR 1152
Action: Final Rule
Subject: Final OSHA respiratory protection standard for general industry and other sectors

OSHA has issued a new final respiratory protection standard to replace those it adopted in 1971 (29 40 C.F.R. ß 1910.134 and 29 40 C.F.R. ß 1926.103). The standard applies to general industry, construction, shipyard, longshoring, and marine terminal workplaces. It requires employers to establish or maintain a respiratory protection program to protect their respirator-wearing employees. The standard contains requirements for program administration; worksite-specific procedures; respirator selection; employee training; fit testing; medical evaluation; respirator use; respirator cleaning, maintenance, and repair; and other provisions. The final standard also simplifies respirator requirements for employers by deleting respiratory provisions in other OSHA health standards that duplicate those in the final standard and revising other respirator-related provisions to make them consistent.

The final rule becomes effective April 8, 1998. OSHA has requested comments on the new or revised information collection paperwork requirements; such comments are due by March 9, 1998. The new paperwork requirements will not take effect until control numbers are assigned to them by the Office of Management and Budget (OMB).

For further information, contact Bonnie Friedman, Director, OSHA Office of Public Affairs, Room N-3647, U.S. Department of Labor, 200 Constitution Ave., N.W., Washington, D.C. 20210, phone: (202) 219-8148.

Proposed Regulations

Environmental Protection Agency
December 24, 1997 - 62 FR 67466
Action: Amended Proposed Rule and Extension of Comment Period
Subject: Amends earlier proposed rule on test guidelines for hazardous air pollutants

On June 26, 1996 the U.S. EPA proposed a rule under section 4(a) of the Toxic Substances Control Act (TSCA) that would require manufacturers and processors of 21 specified hazardous air pollutants (HAPs) to test those HAPs for certain health effects. EPA has now modified its original proposal by substituting new TSCA health effects test guidelines for those in the original proposal. The Agency is soliciting comments on the application of these new guidelines to the amended proposed test rule. Also, the Agency is amending the proposed HAPs test rule by removing the testing requirements for phenol; specifying export notification requirements; reviewing the status of the proposals for enforceable consent agreements for pharmacokinetics studies submitted by industry; revising the economic assessment; including additional support documents in the rulemaking record; and describing other changes and clarifications to the proposed test rule. Comments on the amended proposed rule were due February 9, 1998.

For further information, contact Susan B. Hazen, Director, Environmental Assistance Division (7408), Rm. ET-543B, Office of Pollution Prevention and Toxics, U.S. EPA, 401 M St. SW, Washington, DC 20460, phone: (202) 554-1404; e-mail: TSCA-Hotline@epamail.epa.gov.

Environmental Protection Agency
December 30, 1997 - 62 FR 67784
Action: Supplemental Proposed Rule
Subject: Modifies earlier proposed rule on VOC emission standards for automobile refinish coatings

On April 30, 1996 the U.S. EPA proposed volatile organic compound emission standards for automobile

refinish coatings. In response to comments, EPA has now proposed several changes to the original proposed rule regarding applicability, test methods, and multi-colored topcoats. Under the modified proposal, the applicability of the rule would be expanded to cover all manufacturers and importers of components of a coating. Any entity recommending a combination of components would be responsible for the compliance of the resulting coating. Other features of the supplemental proposed rule include: an exemption for touch-up coatings; the adoption of new test methods; and the addition of multi-colored topcoats to the specialty coatings category. Comments were due on the supplemental proposed rule by February 13, 1998.

For further information, contact Mark Morris, Organic Chemicals Group, Emission Standards Division (MD-13), U.S. EPA, Research Triangle Park, NC 27711, phone: (919) 541-5416.

Environmental Protection Agency
January 9, 1998 - 63 FR 1536
Action: Proposed Rule
Subject: Storm water program (Phase II)

The existing National Pollutant Discharge Elimination System (NPDES) storm water program (Phase I) regulates polluted runoff from a large number of priority sources, including major industrial facilities, large and medium city storm sewers ("municipal separate storm sewer systems" or "MS4s"), as well as construction sites that disturb 5 or more acres. The NPDES storm water regulations (Phase II) that EPA is now proposing, which will be finalized by March 1, 1999, would expand this existing national program to smaller municipalities and construction sites that disturb 1 to 5 acres. Comments are due April 9, 1998.

For further information, contact George Utting, Office of Wastewater Management, U.S. EPA, Mail Code 4203, 401 M St. S.W., Washington D.C. 20460, phone: (202) 260-5816; e-mail: sw@epamail.epa.gov.

For more on the implications of the storm water proposal, see the article in the Update Analysis section of this Regulatory Update.

Notices

Consumer Product Safety Commission
December 1997
Action: Announcement of enforcement initiative
Subject: Labeling of five-gallon plastic buckets

It was recently announced that the CPSC intends to use its enforcement authority to require manufacturers of products packaged in five-gallon plastic buckets, including paint and coatings manufacturers, to label those containers in accordance with the applicable ASTM standard.

For copies of ASTM Standard F1615-95, "Standard Specification for Cautionary Labeling of Five-Gallon Open Head Plastic Containers," contact ASTM at (610) 832-9585.

Environmental Protection Agency
January 9, 1998
Action: Announcement of rulemaking schedule
Subject: VOC emissions from AIM coatings

The U.S. EPA has announced that it expects to issue its rule regulating volatile organic compound (VOC) emissions from architectural and industrial maintenance (AIM) coatings by August 15, 1998.

Environmental Protection Agency
January 9, 1998 - 63 FR 1464
Action: Notice
Subject: Receipt of test data from TSCA Chemical Testing

U.S. EPA has received test data on n-amyl acetate (CAS No. 628-63-7) and alkyl glicidyl ether (CAS No. 120547-52-6). These data were submitted pursuant to enforceable testing consent agreements/orders issued by EPA under section 4 of the Toxic Substances Control Act (TSCA). N-amyl acetate is primarily used as a solvent for nitrocellulose lacquers and paints. Other large uses are as extraction solvents in penicillin manufacture and electrostatic spray coatings for automobiles. Miscellaneous uses include as a solvent in photographic film. Alkyl glicidyl ether is used as an epoxy resin additive and as a modifier for other epoxides. EPA is currently conducting its review and evaluation process for these data submissions.

For further information contact Susan B. Hazen, Director, Environmental Assistance Division (7408), Office of Pollution Prevention and Toxics, U.S. EPA, Rm. E-543B, 401 M St. S.W., Washington, DC 20460, phone: (202) 554-1404; e-mail: TSCA-Hotline@epamail.epa.gov.

Federal Legislation

The first session of the 105th Congress adjourned on November 13, 1997. The second session will convene January 27, 1998. Next month's *Regulatory Update* will include a discussion of developments in the early days of the new legislative session.

State Regulations

ALABAMA

Air Quality (Proposed Rule)—The Alabama Department of Environmental Management (ADEM) is proposing to revise the Environmental Management Commission's regulations at AAC 335-3-14 through 335-3-17 to change the definition of Volatile Organic Compound to conform to changes in Federal mandates and requirements. Comments were due January 19, 1998. For further information, contact Olivia H. Jenkins, ADEM, Environmental Management Commission, PO Box 301463, Montgomery, AL 36130-1463.

ARIZONA

Air Quality (Final Rule)—The Arizona Department of Environmental Quality (ADEQ) has amended its rule on federal hazardous air pollutants at R-18-2-1101 to incorporate by reference recently promulgated National Emission Standards for Hazardous Air Pollutants (NESHAP). The recent NESHAPs incorporated in the rule include those for Group I Polymers and Resins (including styrene, n-hexane, 1,3-butadiene, acrylonitrile, methyl chloride, hydrogen chloride, carbon tetrachloride, chloroprene and toluene) and those for Group IV Polymers and Resins (including acrylonitrile butadiene styrene resin (ABS), styrene acrylonitrile resin (SAN), methyl methacrylate acrylonitrile butadiene styrene resin (MABS), methyl methacrylate butadiene styrene resin (MBS), polystyrene resin, poly (ethylene terephthalate resin (PET), and nitrile resin.

The rule became effective December 4, 1997. For

further information, contact Mark Lewandowski, ADEQ, (602)207-2230.

CALIFORNIA

Air Quality (Final Rule)—The California Air Resources Board (CARB) has amended regulations under 17 CCR 94508 through 94515, 94517 and 94521 on reducing VOC emissions from aerosol coating products. The new rule: postpones the 25% standard for aerosol adhesives; exempts perchloroethylene from the definition of volatile organiccCompound; and amends the test method regulations to prohibit the creation, alteration, falsification or other modification of records which would lead to inaccuracies regarding product formulation or manufacturing information. The rule became effective November 18, 1997. For further information, contact Rich Bradley, CARB, (916) 322-6076.

Air Quality (Final Rule)—CARB has adopted new Test Method 310 for the determination of VOCs in consumer products. Method 310 will be used to determine compliance with applicable VOC limits. The new method is incorporated by reference in CARB's regulations for antiperspirants and deodorants, consumer products and aerosol products. The rule became effective November 13, 1997. For further information, contact George Lew, CARB, (916) 263-1630.

Air Quality (Final Rule)—The board of the South Coast Air Quality Management District (SCAQMD), at its December 12, 1997 monthly meeting, approved Rule 2503, which establishes reporting, recordkeeping and monitoring requirements for the initial phase of an air emissions intercredit trading scheme scheduled to take effect January 1, 1998. The rule specifies procedures by which emitters can demonstrate compliance with the Air Quality Investment Program (AQIP), a program adopted by SCAQMD in the Spring of 1997 which allows payments into an air pollution fund in lieu of compliance with some source-specific standards. Participants in the AQIP program can obtain emission reduction credits which may be applied toward satisfying other emission control requirements. Under Rule 2503, coating operations calculate their credits according to a different set of equations than that used by noncoating operations. For further information, contact SCAQMD at (909) 396-2000.

Proposition 65 (Final Rule)—The California Environmental Protection Agency (Cal-EPA), Office of Environmental Health Hazard Assessment (OEHHA) has added benzene to the list of chemicals known to cause cancer or reproductive toxicity according to the criteria set forth at 22 CCR 12306. The listing became effective December 26, 1997. For further information, contact OEHHA, (916) 445-6900.

Water Quality (Final Rule)—The California Water Resources Control Board (WRCB) has amended its regulations governing the Water Quality Enforcement Policy. The amended regulations implement procedures for minor violations by defining which types of violations are suitable for enforcement by means of a Notice to Comply. The rule became effective December 10, 1997.

ILLINOIS

Air Quality (Final Rule)—The Illinois Pollution Control Board (PCB) has promulgated new regulations under 35 IAC Part 205 creating an emissions reduction market system which will operate in the Chicago ozone nonattainment area and will allow trading of Allotment Trading Units that grant a seasonal entitlement to emit quantities of VOCs. The rule became effective November 25, 1997. For further information, contact Dorothy Gunn, Clerk of the Pollution Control Board, (312) 814-6931.

INDIANA

Air Quality (Proposed Rules)—The Indiana Air Pollution Control Board (APCB) has proposed amendments to 326 IAC 6, Particulate Rules; 326 IAC 8, VOC Rules; and 326 IAC 20, Hazardous Air Pollutants. Comments were due February 4, 1998. For further information, contact the APCB, (317) 232-8229.

KENTUCKY

Hazardous Materials Transportation (Proposed Rule)—The Kentucky Transportation Cabinet has proposed rules at 601 KAR 1:025 regarding the transportation of hazardous materials by air or highway. Comments were due December 22, 1997.

MAINE

Lead (Proposed Rule)—The Maine Department of Environmental Protection (DEP) is proposing lead management rules under Chapter 424 which would provide procedures and requirements for the certification of persons engaged in lead-based paint activities, work practice standards for performing such activities, and accreditation of training providers and training programs. The rules would permit only individuals and firms licensed pursuant to these regulations to conduct lead inspections, risk assessments, and lead abatement design and activities, except for certain specific exemptions. The rules would establish standards and procedures for establishing that residential dwellings and facilities occupied by children are lead-safe. Comments were due January 26, 1998. For further information, contact Carole Cifrino, DEP, (207) 287-7720.

MISSISSIPPI

Lead (Proposed Rule)—The Mississippi Department of Environmental Quality (DEQ) is proposing to revise its regulations on lead-based paint activities. The revisions would: incorporate provisions of federal regulations concerning accreditation of lead-based paint activity training programs; establish procedures and requirements for the certification of individuals and firms engaged in lead-based paint activities; and specify work practice standards for performing lead-based paint activities. A hearing was scheduled for January 6, 1998. For further information, contact Dwight Wylie, DEQ, (601) 961-5171.

NEW JERSEY

Water Quality (Proposed Rule)—The New Jersey Department of Environmental Protection (DEP) has proposed readoption without change of its storm water management regulations at NJAC 7:8, which were set to expire February 5, 1998. DEP anticipates proposing a substantially revised storm water rule in the Spring of 1998; this reproposal is intended to continue the current regulations in force only until the public comment process and adoption of the new rule are completed. Comments were due January 14, 1998. For

further information contact Elizabeth Rosenblatt, DEP, (609) 984-0058.

OKLAHOMA

Water Quality (Proposed Rule)—The Oklahoma Water Resources Board (WRB) is proposing to revise various provisions of Oklahoma's Water Quality Standards under OAC 785:45. The revisions include regulations concerning applicability of narrative and numerical criteria, and the repeal and reenactment of rules concerning requirements for the development of site-specific criteria for metals. Comments were due January 22, 1998. For further information, contact Derek Smithee, WRB, (405) 530-8800.

OREGON

Lead (Final Rule)—The Oregon Construction Contractors' Board (CCB) has adopted regulations at OAR 812-001 to 812-070 establishing requirements for the licensing of individuals and the registration of businesses engaged in lead-based paint activities. The rule became effective November 3, 1997. For further information, contact Cathy Heine, CCB, (503) 378-4621.

PENNSYLVANIA

Lead (Final Rule)—The Pennsylvania Department of Labor and Industry (DLI) has adopted regulations under 34 Pa. Code Chapter 203 that prescribe accreditation requirements and procedures for lead-based paint activity training providers and procedures for lead-based paint occupations. The rule requires that the DLI's regulations be no more stringent than the Federal standards. The rule became effective November 8, 1997. For further information, contact Sharon K. Lawson, Administrator, Asbestos Section, Bureau of Occupational and Industrial Safety, DLI, Room 1402, Labor and Industry Bldg., Seventh and Forster Streets, Harrisburg, PA 17120.

TENNESSEE

Air Quality (Withdrawal of Rule)—The Tennessee Department of Environment and Conservation (DEC) published notice in the Tennessee Administrative Register, 23:12 TAR 1 (December 15, 1997) that it has withdrawn Rule 1200-3-18-.43, concerning Offset Lithographic Printing Operations, which was to have become effective on November 11, 1997. The rule would have exempted printing operations with less than 100 tons per year of VOC emissions from VOC emissions limits, replacing the current exemption threshold level of 25 tons per year.

For further information, contact Malcolm Butler, Division of Air Pollution Control, DEC, (615) 532-0600.

Air Quality (Proposed Rules)—The Tennessee DEC has proposed amendments to Chapter 1200-3-9, Construction & Operating Permits, and Chapter 1200-3-18, Volatile Organic Contaminants.

The amendments would exempt 16 compounds used as refrigerants, aerosol propellants, fire extinguishants, blowing agents and solvents from applicability under these rules due to their negligible contribution to tropospheric ozone formation. Comments were due Jan. 21, 1998. For further information, contact Malcolm Butler, Division of Air Pollution Control, DEC, (615) 532-0600.

TEXAS

Air Quality (Proposed Rules)—The Texas Natural Resources Conservation Commission (TNRCC) is proposing to amend its regulations under 30 TAC Ch. 115 concerning surface coating processes and to add rules on wood furniture coating and shipbuilding repair coating to its current VOC emission regulations under Chapter 115. Comments were due January 19, 1998. For further information, contact Lisa Martin, TNRCC, (512) 239-1488.

Air Quality (Proposed Rule)—The TNRCC is proposing amendments to its regulations under 30 TAC 106.4 concerning requirements for exemption from permitting. The amendments relate to current permitted allowances for VOCs and nonattainment new source review. Comments were due January 19, 1998. For further information, contact Lisa Martin, TNRCC, (512) 239-1488.

Air Quality (Final Rule)—The TNRCC adopted new regulations at 30 TAC 115.950 governing VOC emissions trading, which will allow emission sources to meet VOC control requirements under 30 TAC Ch. 115 through the use of certain types of credits. The rule became effective December 19, 1997. For further information, contact Heather Evans, TNRCC, (512) 239-1970.

Lead (Proposed Rule)—The Texas Department of Health (DOH) is proposing to amend regulations under 25 TAC 295.201 through 295.220 regarding certification and accreditation of lead-based paint management activities in target housing and facilities occupied by children. Comments were due January 12, 1998. For further information, contact Claren Kotria, DOH, (512) 834-6600.

VERMONT

Air Quality/Occupational Health & Safety (Final Rule)—The Vermont Department of Health (DOH) has adopted Vermont Occupational Safety and Health (VOSHA) Rule 13 140 059, incorporating by reference federal air contaminant rules on Methylene Chloride at 29 CFR Parts 1910, 1915 and 1926. The rule became effective November 15, 1997. For further information, contact Ray McCandless, Occupational & Radiological Health Division, DOH, (802) 828-2886.

WYOMING

Air Quality (Final Rules)—The Wyoming Department of Environmental Quality (DEQ) has amended its rules regarding National Emission Standards for Hazardous Air Pollutants, the Acid Rain Program, and Operating Permits. The amendments became effective December 12, 1997. For further information contact the DEQ Air Quality Division, Herschler Bldg., 4th Floor, 122 West 25th St., Cheyenne, WY 82002.

International Activity

DENMARK

Proposed Ban on Lead-Containing Products

The Danish Environmental Agency has circulated a proposal to prohibit the sale, import, or production of lead compounds and certain products containing lead compounds. The proposal would allow Danish companies to export manufactured products containing lead.

MEXICO

Final Mexican VOC Standards Expected to be Promulgated Soon

Sources at the Mexican National Institute of Ecology — the government entity under the Ministry of Environment, Natural Resources, and Fisheries ("SEMARNAP") that is responsible for drafting environmental standards — have stated that they soon expect to issue final volatile organic compound ("VOC") standards regulating automobile coating and painting processes. The government officials indicate that they do not expect that there will be substantial changes from the proposed standards. The proposed Mexican Official Norm ("NOM") was published in Mexico's *Federal Register* (the "*Diario Oficial*") on August 4, 1997 and was subject to a ninety (90) day public comment period. The proposed NOM establishes minimum emission levels of VOCs for coating processes in automobile production and methods for calculating emissions. SEMARNAP officials stated that they expect to promulgate additional regulations addressing the manufacturing and importation of solvent-based, air-dried paints, as well as procedures for determining VOC content in paints and coatings, during the coming year.

SWEDEN

Proposed New Policy on Substances in Products

The Swedish Ministry of the Environment has proposed a new chemical policy calling for all products on the market in 2007 to be free from substances that are persistent and liable to bioaccumulate, and substances that give rise to serious or irreversible effects on health or the environment. The proposed policy specifically targets lead, mercury, and cadmium.

UNITED KINGDOM

Local Air Quality Regulations Established

The Air Quality Regulations 1997, which became effective on December 23, 1997, require local authorities to review air quality in their areas and draw up action plans. The action plans must provide for solving, by 2005, any local air quality problems arising from any of seven pollutants: benzene, 1,3-butadiene, carbon monoxide, lead, nitrogen dioxide, fine particulates, and sulfur dioxide. This new local air quality management system will begin with a nationwide survey of air quality. Local authorities will then have a duty to target and clean up any pollution "hot spots" within their jurisdictions.

Update Analysis: Focus on Storm Water Regulations

EPA Proposes to Extend "No Exposure" Exemption From Storm Water Regulation

On January 9, 1998, the U.S. Environmental Protection Agency issued its long-awaited proposed storm water rule. The regulations were the result of a two-year advisory committee process and were intended to respond to issues raised by the U.S. Court of Appeals for the Ninth Circuit in its partial remand of EPA's earlier storm water regulations. Under a consent agreement, the regulations must be finalized by March 31, 1999. EPA is accepting comments on the proposal until April 9, 1998. One portion of the proposed rule may be of particular importance to FSCT members — the expansion of the "no exposure" exemption from storm water regulation.

The existing storm water regulations allow an exemption from all storm water regulation if no industrial activities or materials at a facility are exposed to precipitation. Under the existing regulations, this exemption is available only for "light industrial" facilities in certain SIC codes. This limitation was held to be arbitrary and capricious by the Ninth Circuit. EPA has responded to the Ninth Circuit's remand of this issue by proposing to make the exemption available to all types of industrial facilities.

Under the proposed exemption, "no exposure" would mean that all industrial materials and activities are protected by storm-resistant sheltering so that they are not exposed to rain, snow, snowmelt, or runoff. The fact that adequately maintained equipment (*e.g.*, trucks or automobiles) could be exposed to precipitation during passage between buildings would not prevent a facility from taking advantage of the "no exposure" exemption. In some circumstances where a permanent no-exposure condition is not possible, state permit writers could allow temporary covers such as tarps to be used between periods of permanent enclosure. Moreover, exposure that results from a leak in a protective covering would be considered exposure only if it is not corrected prior to the next storm water event.

To take advantage of the "no exposure" exemption, facility operators would have to submit a certification every five years. The proposed certification contains a checklist designed to ensure that no type of industrial material or activity is exposed to precipitation.

CDIC—NOVEMBER

"Exterior Latex House Paint"

Society Representative Bill Hollifield, of D&L Paint, reported on the FSCT Board of Directors meeting in Atlanta, GA. Mr. Hollifield noted that the 1998 budget was approved. In addition, there will be a five dollar dues increase for FSCT and a five dollar dues increase for the Society in 1998.

Mr. Hollifield announced that the official membership year has been changed to begin July 1.

The Arizona Society has been voted into the FSCT.

Bylaws Committee Chair Paul Guevin, of P.R. Guevin Associates Inc., announced that he will be changing the Society's Bylaws to reflect the FSCT's Bylaws' changes.

President Teresa Case, of ITW Evercoat Co., Inc., urged members to submit an application for the Lew Larson Grant.

Southern Society member Thad T. Broome, of J.M. Huber Corp., presented "EXPOSURE STUDIES OF EXTERIOR LATEX HOUSE PAINT CONTAINING KAOLIN CLAY PIGMENTS."

Mr. Broome reported on a study of exposure data collected over a six-year period. Four to five hundred panels were used to analyze kaolin clay as an extender in interior applications, and it was found that the effect of kaolin is equal in exterior and interior applications. Vinyl and acrylic emulsion were the two resins tested with the following six pigments: calcium carbonate, conventional calcined clay, paper grade fine particle premium calcined clay, conventional delaminated clay, kaolin based structured pigment for TiO_2, and kaolin based structured pigment for sheen control.

Standardization by opacity, brightness and tinting strength were the criteria used to balance the distinction between fine and coarse particle size. The primer specified was a basic non-stain blocking latex house primer. One evaluation site was Huber, GA, where two coats were applied over the latex primer on southern yellow pine with 45° South exposure in both white and gray tints using lamp black universal colorant.

A second evaluation site was Charlotte, NC, on unical test fence with an alkyd primer and no primer on white pine with south and north vertical and south 45° exposure using blue tint.

The Huber panels were pulled after 16 months of exposure and a zero to 10 rating system was applied to general appearance and statistical analysis with 10 being perfect. The aspects of, resistance to chalking, mildew, dirt collection, and darkening were weighed. Peeling and cracking were not a factor. The Cary, NC, panels were pulled after 24 months for evaluation by the same criteria. A third site, Miami, FL, was utilized and exposure data was collected for a 72-month period.

According to Mr. Broome, two-year results at all three locations demonstrated that calcium carbonate always looked better over alkyd primer for mildew resistance. Also determined was the superiority of carbonate in formulating for resistance in harsh fade applications despite the other potential problems it can pose. Conventional calcined clay presented the best scrub resistance and overall performance making it an excellent compromise, he concluded.

BRIAN MARZANO, *Secretary*

CDIC—DECEMBER

"Solsperse Hyperdispersants"

Society Representative Bill Hollifield, of D&L Paint, recognized membership Chair Dennis Nie, of Perry & Derrick Co., Inc., for the six percent increase in members.

Ohio Paint Council Representative, Paul Guevin, of P.R. Guevin Associates, Inc., reported that the Council is seeking the support of the CDIC Society regarding the aggregation rights for mutual interest regarding electricity rates.

In addition, Mr. Guevin, Bylaws Committee Chair, announced that the January meeting notice will include a ballot to address the change in Bylaws. The issues being questioned are the following: FSCT collecting dues from new members and changing the year end date to June 30.

The evening's technical speaker was Piedmont Society member Jan M. Weernink, of Zeneca Pigments and Ad-

Baltimore Society Presents Annual Awards

The Baltimore Society for Coatings Technology and the Baltimore Paint and Coatings Association hosted their 42nd Annual Awards Council Dinner at Martin's West in Baltimore, MD.

The following awards were presented: Peter Rengel, of RJ Chemical, was presented with the prestigious Herman Shuger Memorial Award. Merit Citations were awarded to: Colin Crowley, of Chemcentral; Frank Gerhard, of Duron Paints; Linda Moore Grumbine, of Lenmar; Connie Sauer, of Bruning Paint; and Mary Somerville, of Bruning Paint.

The Awards Committee, chaired by Helene Ranfone, of Duron Paint, announced the presentation of Scholarship Awards to Troy A. Franz, whose father, James, is employed by Bruning Paints, and to Lewis R. Raszewski, Jr., whose father, Lewis Sr., works for R. P. & C., Inc.

1995 Herman Shuger Memorial Award winner James Smith, of Eastech (left), presents this year's award recipient Peter Rengel, of RJ Chemical (top photo).

In the top right photo, Tom Mitchell, Master of Ceremonies for the evening's festivities, presents Colin Crowley, of Chemcentral, with a Merit Citation. In the bottom right photo, Frank Gerhard, of Duron Paints (left), receives a Merit Citation from Mr. Mitchell.

At the December meeting of the CDIC Society, Society Representative Bill Hollifield, of D&L Paint Co. (left), presented Society Membership Chair Dennis Nie, of Perry & Derrick, with a Membership Certificate the Society received from the FSCT for having one of the largest increases in membership for 1996-97.

ditives. He discussed "SOLSPERSE HYPERDISPERSANTS FOR AUTOMOTIVE AND INDUSTRIAL BASED PAINTS."

According to Mr. Weernink, solsperse hyperdispersants can be used to lower costs and increase productivity. This is attributed to the efficient dispersion and stabilization of pigments. Dispersants reportedly provide excellent pigment wetting and stabilization.

Mr. Weernink noted that two types of dispersants are available: polymeric and synergistic. Polymeric dispersants are for polar or inorganic pigments. Synergistic dispersants, on the other hand, are for non-polar and organic pigments.

The synergists aid in formulation by reducing VOCs and are effective as pigment wetters. This enables the freer selection of millbase grinding resins for properties other than their wetting capabilities. Additionally, resins do not stabilize.

The speaker noted that the dispersant acts to prevent flocculation, resulting in greater color strength which lowers pigment costs, and less mill time is needed due to prevention of reaggregation. This lessens equipment wear, energy, and labor costs.

Maximized benefit of a dispersant in a mill-base resin can be realized by optimizing the amount of each so that they do not compete for attachment to pigment surfaces. Typically a 20% resin-solids solution should be used for the grinding medium.

Mr. Weernink recommended figuring the percent of dispersant on weight of pigment by dividing the pigment's surface area by five. Correct dosage results in optimum performance through maximum stability and maximum viscosity allowing for maximum pigment loading. Too little dispersant limits the results due to limited coverage. However, steric stability is still present. Too much dispersant can clutter the steric barrier and collapse it resulting in flocculation.

Q. In applications with black, is conductivity affected?

A. Yes, increases in conductivity are reported.

BRIAN MARZANO, *Secretary*

CDIC—JANUARY

Education Night

A moment of silence was observed for Lew Larson, CDIC Honorary member who passed away recently.

Nominating Committee Chair William Jelf, of Akzo Nobel Coatings Inc., announced that the current officers have agreed to run for their successive offices. Sherill Heneger, of Reilly Industries, has accepted the nomination for Treasurer.

The 1998 Education Night consisted of the following presentations: Jack Avery, of Cintech Industrial Coatings, spoke on "EPOXY RESINS," Joe Schinner, of Akzo Nobel Coatings Inc., discussed "ALKYDS, OILS, AND COPOLYMERS," and Bill Jelf covered "URETHANES IN COATINGS."

BRIAN MARZANO, *Secretary*

CLEVELAND—NOVEMBER

"Additives in Waterborne Coatings"

Ben Carlozzo, of DCA Coatings, presented the A.F. Voss Award check for $600 to the Society. In addition, it was also announced that Mr. Carlozzo received second place in the Society Speaker's Award Competition during the FSCT Annual Meeting.

The evening's technical presentation was given by Robin Reinhardt, of Tego Chemie U.S.A. He spoke on "ADDITIVES IN WATERBORNE COATINGS—PRESENT AND FUTURE."

Mr. Reinhardt discussed different additives being used to control the problems encountered when using water instead of solvent in paint systems. The speaker explored the use of foam control additives as well as those used for corrosion resistance, including gloss development, adequate pigment wetting, surface defects, scratch resistance, mar and slip resistance, and improved substrate wetting.

Mr. Reinhardt also covered additives of the future. These included no VOC additives and those that would have no effect on gloss or clarity.

PAT WAGLE, *Secretary*

GOLDEN GATE—NOVEMBER

UV/EB Curing

The evening's speaker was Kirk Willard, of UCB Radcure. He discussed "INDUSTRIAL APPLICATION OF UV/EB CURING."

According to Mr. Willard, there are two distinct chemistries of UV/EB curable inks, namely free radical and cationic systems. A free radical system can be characterized as a predominately acrylate functional material, which is a rather abundant raw material. It is inhibited by oxygen but not by moisture. Also, it cures in a matter of a few seconds. However, the adhesion has left much to be desired. In addition, free radical systems costs less than cationic systems.

Mr. Willard stated that cationic systems are basically cycloaliphatic and are composed of epoxy functional materials. In this regard, they have very limited raw materials. As compared to free radical systems, cationic systems are not inhibited by oxygen but by moisture. Also, they do not fully cure until after a couple of hours. However, the adhesion is excellent.

The speaker noted that the major application areas are adhesives, inks, and coatings. For adhesives, they can be used for both laminating and pressure sensitive adhesives.

In inks, UV inks can be used as screen inks for compact dics, instrument displays, and HDPE. In fact, noted Mr. Willard, UV/EB curable inks are a significant portion of the non-apparel screen ink market. They can also be used for dry offset printing such as tube and cup printing. Consequently, lithography printing can also be achieved in carton and metal deco printing. In fact, UV/EB curable inks have also been established for narrow-web printing. Lastly, they can also be used for pad printing (printing on irregular surfaces) namely golf balls or keyboards.

In coatings, UV curable inks can be used for a wide variety of substrates, such as paper, plastic, metal, and wood. In paper, they can be used as overprint varnishes for magazines, periodicals, and various packaging products. Interestingly, they also can be used for security inks in lottery tickets and checks.

For plastics, the inks can be used for PVC (flooring), PC (compact dics, in-

Past-Presidents in attendance at the November 1997 meeting of the Kansas City Society for Coatings Technology.

strument displays), and PET (solar window films).

For metals, they can be used as coatings for three-piece steel containers as over print varnishes for can bodies (free radical) or as lacquers for can ends (cationic).

Finally, UV/EB curable inks can be used on wood as fillers or sealers for clear and pigmented top coats.

GENE ARBATIN, *Secretary*

KANSAS CITY—NOVEMBER

General Membership Meeting

The following Kansas City Society Past-Presidents were in attendance: J.C. Leslie, Dick Smith, Mark Algaier, of Hillyard Industries, Inc.; Craig Hughes, of Hallmark Cards, Inc.; Yvonne D'Arcy, of Cook Composites & Polymers; Lawrence Murphy, of Tnemec Co., Inc.; Bill Porter, of Hillyard Industries Inc.; Randy Ehmer, of Walsh & Associates, Inc.; Gene Wayenberg, Mike Bauer, of Tnemec Co., Inc.; Bill Fitzpatrick, Dick Warren, Jim Edwards, and Norman Hon, of Davis Paint Co.

The following 50-year members were recognized: Ray Frederick and Harry Oliver.

In addition, Gene Wayenberg, of Tnemec Co., Inc., and Jerry Frizell, of Centri Coatings & Systems Corp., were acknowledged as 25-year members.

Society Representative Mark Algaier, of Hillyard Industriels Inc., reported on the FSCT Annual Meeting, in Atlanta, GA.

Ray Fredrick (left) and Harry Oliver were presented with 50-year membership pins at the November meeting of the Kansas City Society.

Fifty-year member Harry Oliver discussed the changes, from a manufacters point of view, in the paint industry over the years.

TOM HILTON, *Secretary*

KANSAS CITY—DECEMBER

General Membership Meeting

Bill Musgrave, Vice President of Science City at Union Station, was the evening's speaker.

Mr. Musgrave reported on the progress of construction of Kansas City's Science City. This science center is scheduled to open November 1999.

TOM HILTON, *Secretary*

LOS ANGELES—JANUARY

FSCT Officer Visit

A moment of silence was held in remembrance of Jack Day, of Stay and Day, and Lew Larson, CDIC Honorary Member.

FSCT President-Elect Forest Fleming, of Akzo Nobel Coatings Inc., reviewed the modified membership process to accept new FSCT members. In addition, he reported that the 27th Society has been formed, with the Arizona Society joining the Federation. Mr. Fleming announced that ICE Latinoamerica '98 will be held on April 15-17, 1998 in Miami, FL.

FSCT Director of Educational Services Mike Bell reported on the activities of the FSCT Committees.

Society President Sandra Dickinson, of Tri-Iso, announced that there will be a $10 increase to the annual dues.

Laura Bittle, of Engineered Polymer Solutions, discussed "HIGH GLOSS CORROSION RESISTANT EMULSIONS."

Ms. Bittle presented effective ways to control rust formation through different paint variables, such as co-solvents, dispersants, flash rust inhibitors, as well as choosing the proper emulsion.

The speaker gave a brief explanation of the chemistry of rust.

She said that the formation of a quality, gloss, corrosion resistant coating needs to be a good balance of most, if not all, of the following: barrier pigments, sacrificial pigments, inhibiting pigments, and ammonium salts.

Ms. Bittle recommended a hydrophobic emulsion as the vehicle. In addition, passivation can be done chemically or naturally to add to corrosion resistance.

The speaker then reviewed a study of eight different latexes formulated to manufacturer's recommendations and tested for corrosion resistant.

Q. How will the corrosion protection of a coating be affected when an acidic pigment, like carbon black, is used in the coating?

A. Samples prepared with carbon black still gave very good results.

DARIN EVERHART, *Secretary*

NEW YORK—NOVEMBER

"Rheology"

Society Representative George Amrich, of Benjamin Moore, reported on the FSCT Board of Directors Meeting held during the FSCT Annual Meeting in Atlanta.

Mr. Amrich announced that the Board passed a $5.00 dues increase for 1998-99. Subscription rates for the JCT were increased to $120 for 1998.

In addition, the Arizona Society was welcomed to the Federation.

The FSCT Board of Directors voted not to remove the NPCA representative from the Board.

President Robert Schroeder, of Daniel Products, Co., announced that the Technical Committee presentation "Reactive Diluents for Two-Component Polyurethane Coatings," won second place in the A.F. Voss/APJ Awards Competition.

The evening's speaker, Richard Eley, of ICI Paints, presented a discussion of rheology.

Dr. Eley discussed rheology from a mathematic standpoint. He pointed out that there are elements of many sciences

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Martin's West, Baltimore, MD). STEPHANIE ROTHENBERG, Thomley Co., 1500 E. Newport Pike, Ste. 204, Wilmington, DE 19804.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). GRAHAME W. FOWKES, Technivelopments Co., 14 Wells Close, Chippenham, Wilts. SN14 0QD, England.

CDIC (Second Monday—Location alternates between Cincinnati, Columbus, Dayton, and Indianapolis). BRIAN P. MARZANO, Sun Chemical Corp., 5020 Spring Grove Ave., Cincinnati, OH 45232.

CHICAGO (First Monday—The Ambassador Restaurant, Elmhurst, IL). SUSAN A. SIMPSON, Chemcept Services, 2 South 902 Heritage Glen Ct., Batavia, IL 60510-5100.

CLEVELAND (Third Tuesday—Monthly meeting sites vary). PATRICIA WAGLE, The Flood Co., 1212 Barlow Rd., Hudson, OH 44236.

DALLAS (Second Thursday following first Wednesday—Dallas Medallion Hotel, Dallas, TX). JOSEPH HILBUN, The Sherwin-Williams Co., 2802 W. Miller Rd., Garland, TX 75041.

DETROIT (Second Tuesday—meeting sites vary). NAOMI SUSS, PPG Industries, Inc., 5875 New King Ct., P.O. Box 3510, Troy, MI 48007.

GOLDEN GATE (Monday before third Wednesday—alternates between Francesco's in Oakland, CA, and Bertolucci's in S. San Franscisco, CA). TIMOTHY G. SPECHT, Flecto Co., 1000 45th St., Oakland, CA 94608.

HOUSTON (Second Wednesday—Medallion Hotel, Houston, TX). STEVEN RAGSDALE, Intercoastal Paint, P.O. Box 38114-433, Houston, TX 77238.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). THOMAS HILTON, Weskem-Hall, Inc. 1424 Atlantic Ave., N. Kansas City, MO 64116.

LOS ANGELES (Second Wednesday—Maggie's Pub, Santa Fe Springs, CA). DARIN EVERHART, Behr Process Corp., 3400 W. Barry St., Santa Ana, CA 92704.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). CAROL WINSLOW RAPP, Dar-Tech, Inc., 101 Glenmill Rd., New Albany, IN 47150.

MEXICO (Every fifteen days—Gabriel Mancera, Mexico City, Mexico). MANUEL MAESTRO NAVARRO, DuPont, S.A. de C.V., Km. 9.5 Via Dr. Gustavo Baz, Col. Barrientos, 54110 Tlalnepantla, Edo de Mexico, Mexico.

MONTREAL (First Wednesday— Restaurant Le Bifthèque, St. Laurent, Quebec). ROBERT BENOIT, Kronos Canada Inc., 3390 Marie Victorin, Varennes, Que., J3X 1T4 Canada.

NEW ENGLAND (Third Thursday—Best Western TLC, Waltham, MA). GARY SMALL, Zeneca Resins, 730 Main St., Wilmington, MA 01887-3366.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). E. ROBERT CARDIN, Rohm and Haas Co., 16 Meadowview Dr., Colts Neck, NJ 07722.

NORTHWESTERN (Second Tuesday—Jax Cafe, Minneapolis, MN). ROBIN L. NORCUTT, George C. Brandt, Inc., 2975 Long Lake Rd., St. Paul, MN 55113.

PACIFIC NORTHWEST (PORTLAND SECTION—Tuesday before third Wednesday—Saylors Old Country Kitchen; SEATTLE SECTION—Third Wednesday—All City Diner; VANCOUVER SECTION—Thursday after third Wednesday—Abercorn Inn, Richmond, B.C.). KELVIN HUGET, Imasco Minerals, Inc., 19287 98A Ave., Surrey, B.C. V4N 4C8, Canada.

PHILADELPHIA (Second Thursday—Doubletree Guest Suites, Plymouth Meeting, PA). NEIL R. SHEARER, Andek Corp., P.O. Box 392, Moorestown, NJ 08057.

PIEDMONT (Third Wednesday—Woman's Club of High Point, High Point, NC). RANDOLPH G. COX, Akzo Nobel Coatings Inc., 1431 Progress St., P.O. Box 2124, High Point, NC 27261.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). JOHN GILLEN, J.M. Gillen Co./Van Horn, Metz & Co., 681 Millers Run Rd., P.O. Box 428, Cuddy, PA 15031.

ROCKY MOUNTAIN (Monday following first Wednesday—DelMonico Hall, Denver, CO). GEORGETTE SIPARSKY, TDA Research, 12345 W. 52nd Ave., Wheat Ridge, CO 80033.

ST. LOUIS (Third Tuesday—The Salad Bowl Restaurant, St. Louis, MO). NICHOLAS HALL, U.S. Paint Corp., 831 S. 21st St., St. Louis, MO 63103.

SOUTHERN (GULF COAST SECTION—third Tuesday; CENTRAL FLORIDA SECTION—third Thursday after first Monday; ATLANTA SECTION—third Thursday; MEMPHIS SECTION—bimonthly on second Tuesday; and MIAMI SECTION—Tuesday prior to Central Florida Section). DALE KENKNIGHT, Akzo Nobel Coatings Inc., 6369 Old Peachtree Rd., Norcross, GA 30071-1780.

TORONTO (Second Monday—Speranza Restaurant & Banquet Hall Convention Centre, Brampton, Ont., Canada). FRANS GROOTVELD, Ciba Pigments, 6860 Century Ave., Mississauga, Ont., L5N 5N3, Canada.

WESTERN NEW YORK—Marko Markoff, 182 Farmingdale Rd., Cheektowaga, NY 14225.

in rheology including physics, physical chemistry, colloid chemistry, mathematics, and continuum mechanics. His aim was to show why rheology should be used and some of the ways it can be of value to people in selling their products.

Dr. Eley showed that flow occurs in many forms besides liquids such as in a cross-section of the earth depicting sharply curved rock strata. By employing force for a sufficiently long period of time on a substance you will witness flow, or permanent deformation—that is basically the definition of rheology.

According to the speaker, flow is the common denominator of paint. Therefore, the economic value for the science of rheology is necessary to ascertain the success of paint. Obtaining proper rheology in the laboratory is difficult and expensive and any small change in ingredients in a can of paint can have a very deleterious effect on the rheology of that paint.

Dr. Eley showed changes in deformation in the film of a coating as it dries and applied developed mathematical formulae to show how energy affects the change in shear stress which in turn, results in changes in the film and flow characteristics. Shear rates vary with the type of application, for example, airless spray being at one end as opposed to brushing at the other. Other things affecting shear rates include sagging, leveling, flocculation, and pigment settling. Also very important to determining shear stress in a coatings is the viscosity in a given material.

The instrumentation for determining viscosity can vary widely in performance and more expensive instruments will help to tell a researcher more about a coating over a wider range of conditions and performance requirements. Comparisons of mathematical models of viscosity curves can tell a formulator a lot about the performance of the coating. Every paint displays a shear rate curve which fits into a general "non-Newtonian" curve of shear rate or shear stress.

Dr. Eley stated that there are four regimes in such a curve: (1) the viscosity is constant over a range of shear rates; (2) a power law shear-thinning regime; (3) upper Newtonian where viscosity is independent of shear rate over a small range of shear rates; and (4) shear thickening regime.

The most important property to achieve coating success is film thickness, said Dr. Eley. Uniformity in film provides optimum leveling, hiding, appearance, and substrate protection. Defect processes have also been avoided. They involve the interreaction between coating rheology and coating process which can be very complex. Most models lack the third dimension for describing these defects. Computer simulation of fluid

flow should be used toefficiently solve coatings processes.

Dr. Eley suggested that fluid dynamics modeling by computer simulation be used. He showed a video demonstrating the technique of a paint film as it dries with time, showing flow, leveling, and/or rheology.

E. Robert Cardin, *Secretary*

NORTHWESTERN—DECEMBER

"Formulating Software"

Darlene Brezinski, of Consolidated Research, Inc., was voted an honorary member of the Society.

President Mike Coad, of McWhorter Technologies, announced that the Technical Symposium will be held March 10, 1998 at the Airport Marriott.

Rory Granros, of Formation Systems spoke on "Formulating Software."

Mr. Granros outlined a software program whose database includes marketing information, specification information, raw material specifications and parameters, and costing information.

Robin Norcutt, *Secretary*

NORTHWESTERN—JANUARY

"Filling Equipment"

President Mike Coad, of McWhorter Technologies, announced that the topic for the March 10 Technical Symposium will be "Surfactants for Formulating Waterborne Coatings."

Dan Jarnagin, of Thiele Engineering, spoke on "Filling Equipment."

Mr. Jarnagin provided a background of filling systems. He discussed hand fill, volumetric filling, net weight/gravimetric, and flowmeter/servo feedback. The speaker discussed the advantages and disadvantages of each system.

In addition, Mr. Jarnagin showed several schematics of new systems recently introduced to the industry. He also covered custom developmental work.

Robin Norcutt, *Secretary*

PHILADELPHIA—DECEMBER

Pigment Dispersing Techniques

Philadelphia Society member Don Denny, of E.W. Kaufmann Co., presented "Pigment Dispersing Techniques."

According to Mr. Denny, high speed dispersers took over from ball and pebble mills approximately 40 years ago. However, pebble mills are still used at times.

Mr. Denny stated that circulation of the mill base may be altered by the shape of the mixing tank. The mixing action is in a hellical pattern as it moves pigment and resin around. The blade must be far enough from the bottom for optimum dispersion. Blade diameter must be matched to tank size so that all of the volume circulates properly.

Vortex size must be controlled to revent foam formation. The tank should be three times the diameter of the blade, the blade should be one-half of its diameter distance from the tank bottom, and the depth of the millbase twice the diameter of the blade.

The speaker recommended that cleaning should take place as the mix progresses to maintain a clean product that does not need excessive filtration. Dispersion is achieved by impact, fluid shear, and circulation. Blade design will provide de-agglomeration of pigment in different ways or circulate sticky resins to dissolve them more efficiently. Some blades work better by being offset from the center of the tank.

Mr. Denny stated that a dispersion blade should run at 5,000 feet per minute; some types can run at 3,000 feet per minute, on up to 6,000 feet per minute, but 5,000 feet per minute is generally considered the standard.

Neil R. Shearer, *Secretary*

PHILADELPHIA—JANUARY

Joint Meeting with PPCA

The evening's presentation was delivered by Hanna Hasl, of Reichhold Chemicals, who discussed "Expanding and Protecting Your Markets."

Ms. Hasl stressed the importance of protecting customer lists, prices, corporate plans, formulas, etc. Confidential information is defined as any information that creates a competitive advantage.

According to the speaker, there is a new criminal law to protect trade secrets. The punishment can include prison terms, company and individual fines, and also seizure of assets and property.

Neil R. Shearer, *Secretary*

PIEDMONT—NOVEMBER

"Micronized Pigments"

Technical Committee Chair Nada Javanovich, of Akzo Nobel Coatings Inc., reported that plans are underway for the 1999 mini-trade show.

Society Representative Gary Marshall, of Chemcraft Sadolin Inc., discussed the FSCT Board of Directors Meeting. He reported that the 1998 budget was approved. He also mentioned that there will be some changes made to the Bylaws. Mr. Marshall informed the members that there will be a dues increase as well.

FSCT President-Elect Forest Fleming, of Akzo Nobel Coatings Inc., elaborated on the membership dues increase. He also discussed the success of ICE '97. Mr. Fleming highlighted ICE Latinoamerica '98 in Miami, FL, on April 15-17 and ICE '98 in New Orleans, LA, on October 14-16.

The meeting's speaker was Charles Hoover Jr., Hoover Color Corp. He presented "Micronized, Easy Sperse, Stir-in Type Pigments.

Mr. Hoover discussed jet milled, easy to disperse, micronized pigments. He stated that the grind of pigments depends on what goes on with the pigments during this step. Pigment particle size and shape determines its color and often times the results, include pigment clusters, aggregates, and agglomerates.

Randy Cox, *Secretary*

WESTERN NEW YORK—DECEMBER

"Rheological Evaluation of Coatings"

FSCT President Tom Hill, of Merlyn Group, was in attendance.

Rich Clark, of Sherwin-Williams Canada was elected Treasurer.

The speaker for the evening was Sean Race, of Paar Physica USA, Inc. He spoke on "Full Rheological Evaluation of Coatings from Low to High Shear Rates."

Mr. Race discussed the important points regarding the underlying principles associated with flow curves, factors to consider in constructing a meaningful test, and data interpretation.

Factors such as equilibrium rest times, time per data point, and inertial effects are all important in understanding whether the results obtained make sense. Generally, most rheometers perform correctly, but designing a robust test protocol requires a great deal of consideration and experience.

Mark Markoff, *Secretary*

Future Society Meetings

Baltimore

(Mar. 19)—"Opaque Organic Pigments—Good Alternatives for Heavy Metal Pigments for the Coatings Industry"—Romesh Kumar, Clariant Corp.
(Apr. 16)—"Organic Silicone Paint Additives"—Kimberly Kucinski, Dow Corning Corp.
(May 21)—Manufacturing—Speaker to be Announced.

Birmingham

(Mar. 6)—"Pigments—Heavy Metal Alternatives"—Jeff Nixon, Shepherd
(Apr. 3)—"Powder Coating Resins"—Garry Kubera, McWhorter
(Apr. 19)—Ladies Night Dinner and Dance.
(May 1)—68th Annual General Meeting.

Chicago

(Mar. 2)—"Ultra High Gloss Latex and Crosslinking Technology"—Gerald Vandezande, Union Carbide Corp.
(Apr. 6)—"A Comparison of Waterborne Epoxy and Solvent Epoxy Systems"—Jim Aloye, Henkel Crop.; and "Formulating Waterborne Epoxies"—Ernie Galgoci, Shell Chemical Co.
(May 8)—Annual Awards Banquet.

Cleveland

(Mar. 17)—"The Role of Surface Modifiers in High-Solids Coatings"—W.R. Pistillo, The Lubrizol Corp.
(Apr. 21)—"Water Reducible Resins and Their Application in Industrial Systems"—Rikki Gogna, Schenectady Chemicals Canada.
(May 19)—"Colorful Art Painting"—Kenneth Be, Cleveland Museum of Art.

Golden Gate

(Mar. 16)—"In-Can Preservation of Coatings Systems"—Scott Brown, Zeneca.
(Apr. 13)—"Comparative Mills—How They Work, Who Should Use Them"—Mark Drunkenbrod, CB Mills.
(May 18)—"Performance Enhancements Through Control of Special Inter-Pigment Phenomena"—Edward Orr, BYK-Chemie.

Kansas City

(Feb. 12)—Web Page & Program.
(Mar. 12)—SSPC/NACE Night. "Current Topics in Cyclic Corrosion"—Glen Bebie, Q-Panel Lab Products.
(Apr. 9)—"Interaction of Associative Thickeners with Surfactants in Latex Paints"—Harold Haag, Aqualon.
(May 14)—Education Night.
(June 5-6)—Joint Meeting with St. Louis Society. Holiday Inn, Lake of the Ozarks, MO.

Los Angeles

(Mar. 11)—"In-Can Preservation of Coatings Systems"—Scott Brown, Zeneca.
(Apr. 8)—"Comparative Mills—How They Work, Who Should Use Them"—Mark Drunkenbrod, CB Mills.
(May 13)—"Performance Enhancements Through Control of Special Inter-Pigment Phenomena"—Edward Orr, BYK-Chemie.

Montreal

(Feb. 4)—"Trade Sales Paint: Feedback from Architects and Professional Painters."
(Mar. 4)—"Principle of Corrosion and Prevention"—Speaker from Wayne Pigment Corp.
(May 6)—"Post-Consumer Paint: Status on Proposed Legislation"—CPCA.

Phoenix

(Mar. 10)—"In-Can Preservation of Coatings Systems"—Scott Brown, Zeneca.
(Apr. 7)—"Comparative Mills—How They Work, Who Should Use Them"—Mark Drunkenbrod, CB Mills.
(May 12)—"Performance Enhancements Through Control of Special Inter-Pigment Phenomena"—Edward Orr, BYK-Chemie.

Pacific Northwest

Portland Section

(Mar. 17)—"In-Can Preservation of Coatings Systems"—Scott Brown, Zeneca.
(Apr. 14)—"Comparative Mills—How They Work, Who Should Use Them"—Mark Drunkenbrod, CB Mills.
(May 19)—"Performance Enhancements Through Control of Special Inter-Pigment Phenomena"—Edward Orr, BYK-Chemie.

Seattle Section

(Mar. 18)—"In-Can Preservation of Coatings Systems"—Scott Brown, Zeneca.
(Apr. 15)—"Comparative Mills—How They Work, Who Should Use Them"—Mark Drunkenbrod, CB Mills.
(May 20)—"Performance Enhancements Through Control of Special Inter-Pigment Phenomena"—Edward Orr, BYK-Chemie.

Vancouver Section

(Mar. 19)—"In-Can Preservation of Coatings Systems"—Scott Brown, Zeneca.
(Apr. 16)—"Comparative Mills—How They Work, Who Should Use Them"—Mark Drunkenbrod, CB Mills.
(May 21)—"Performance Enhancements Through Control of Special Inter-Pigment Phenomena"—Edward Orr, BYK-Chemie.

Rocky Mountain

(Mar. 9)—"In-Can Preservation of Coatings Systems"—Scott Brown, Zeneca.
(Apr. 6)—"Comparative Mills—How They Work, Who Should Use Them"—Mark Drunkenbrod, CB Mills.
(May 11)—"Performance Enhancements Through Control of Special Inter-Pigment Phenomena"—Edward Orr, BYK-Chemie.

DALLAS and HOUSTON SOCIETIES PRESENT

55th Annual Southwestern Paint Convention

"New Nuts and Bolts to Keep Your Brushes Rolling"

March 25-27, 1998

Del Lago Resort and Conference Center

Conroe, TX

For more information, contact Gary or Charmaine Phillips, c/o Picco Coatings, Inc., 11601 McKinley, Houston, TX 77038; Phone: (281) 447-8877.

BALTIMORE

Active

Aellen, Veronique B.—Duron, Inc., Beltsville, MD.
Davis, Glenn R.—Duron, Inc., Beltsville.
Gogoel, Michael J.—BYK-Gardner USA, Columbia, MD.
Lee, Chi S.—The Sherwin-Williams Co., Baltimore, MD.
Odita-Honnah, Nnamdi—Duron, Inc., Beltsville.
Meth, Jeffrey Scott—E.I. DuPont Co., Wilmington, DE.
Szabo, Les J.—Duron, Inc., Beltsville.

Associate

Ahrens, Scott—BYK-Gardner USA, Columbia, MD.
Hepner, Suzanne M.—Bruning Paint Co., Baltimore, MD.
Neal, Nicole C.—Zeneca Biocides, Wilmington, DE.

DETROIT

Active

Haskell, Brad A.—The Sherwin-Williams Co., Troy, MI.
Schang, Craig S.—BASF Corp., Southfield, MI.
Stark-Kasley, Lori A.—Dow Corning, Midland, MI.
Weiland, Timothy J.—The Sherwin-Williams Co., Warren, MI.

Associate

Anderson, M. Suzanne—Fausone Taylor & Bohn, Northville, MI.
Lin, Jianwu—Albar Industries Inc., Lapeer, MI.

KANSAS CITY

Active

Duvenci, Darvene A.—Regional Crime Lab., Kansas City, MO.

LOS ANGELES

Active

Hong, Harry—Ameron Inc., Brea, CA.
Lieser, Bernard H.—Rohm & Haas Co., Spring House, PA.
Lim, William T.—Delta Technical Coatings Inc., Whittier, CA.
Lo, Tinbo—Courtaulds Aerospace, Burbank, CA.
Omar, Ayman A.—Courtaulds Aerospace, Burbank.
Savin, Ronald R.—Rancho Mirage, CA.

Associate

Bales, Dan—Calsol Inc., Pomona, CA.
Bosveld, Timothy P.—Dunn-Edwards Corp., Los Angeles, CA.
Bristow, Larry G.—ChemCentral, Dallas, TX.
Hutzler, Chuck—Ashland Chemical Co., Santa Ana, CA.
Langjahr, Mitch J.—Ashland Chemical Co., Huntington Beach, CA.
Roff, Margaret—Calsol Inc., Pomona.
Zimmerman, Bill—Trans Western Chemicals, Pico Rivera, CA.
Woo, Michael G.—Witco Corp., Irvine, CA.

Educator/Student

Cruz, Pia—Rosemead High School, Whittier, CA.

NEW YORK

Active

Alvarado, Fernando—Spraylat Corp., Mount Vernon, NY.
Chen, Mao—General Electric, Niskayuna, NY.
Drucker, Daniel A.—Randolph Products, Carlstadt, NJ.
Goetze, Daniel G. III—Insl-x Products Corp., Stony Point, NY.
Igbokwe, Edward O.—The Sherwin-Williams Co., Newark, NJ.
Lees, Robert G.—Cytec Industries, Stamford, CT.
Ochs, James—Crossfield Products Corp., Roselle Park, NJ.
Scanlon, Kevin M.—Benjamin Moore & Co., Flanders, NJ.
Siuda, Eva L.—Spraylat Corp., Mt. Vernon, NY.
Tavaska, Robert S.—Panelgraphic Corp., West Caldwell, NJ.
Urbanski, Arthur N.—Binney & Smith Inc., Easton, PA.

Associate

Herrmann, Bruce W.—Hercules Inc., Parlin, NJ.
Hunter, Brian T.—S.P. Morell & Co., Sandy Hook, CT.
Joshi, Vipul—Ciba Specialty Chemicals, Brewster, NY.
Lapierre, David A.—Omya Inc., Proctor, VT.
Marsland, John E.—Van Horn, Metz & Co., Inc., Conshohocken, PA.
McAllen, Thomas—Cook & Dunn Enterprises, Lodi, NJ.
McNiff, Joseph P.—E.W. Kaufman Co., Mt. Laurel, NJ.
Millard, Keith A.—Ashland Chemical Co., Boonton, NJ.
Nerlfi, Steven J.—Kusumgar, Nerlfi & Growney, North Caldwell, NJ.
Peters, Joseph J.—The Leneta Co., Mahwah, NJ.
Rucker, Benjamin A.—Dock Resins Corp., Linden, NJ.
Vasisht, Suresh—Seegott Inc., Parsippany, NJ.
Veress, Alexander R.—M & R Marking Systems, Piscataway, NJ.

NORTHWESTERN

Active

Jacobs, Gregory F.—Corning Incorporated, Corning, NY.

Associate

Fleck, Christopher J.—Van Waters & Rogers, St. Paul, MN.
Krish, Jack—Fitz Chem Corp., Elmhurst, IL.

PHILADELPHIA

Active

Hess, Robert A.—Armstrong World Industries, Lancaster, PA.

ST. LOUIS

Active

Garza, Sam—U.S. Paint Co., St. Louis, MO.
Gibson, Don J.—Amteco, Pacific, MO.
Peter, Michael E.—Elpaco Coatings Corp., St. Louis, MO.

SOUTHERN

Active

Perkins, David W.—Amoco, Houston, TX.

TORONTO

Associate

Hazell, David M.—Chemroy Canada Inc., Mississauga, Ont.
MacGuire, Sean M.—Henkel Canada Ltd., Mississauga.
Maurer, Pierre—Ciba Specialty Chemicals, Mississauga.
Tran, Lap M.—Tarxien Components, Concord, Ont.

JCT
JOURNAL OF COATINGS TECHNOLOGY

For advertising in the JOURNAL OF COATINGS TECHNOLOGY, contact Scott Walter, National Advertising Representative, 22785 Cass Ave., Woodland Hills, CA 91364; Phone: (818) 224-3226; Fax: (818) 222-0194

People in the News

D. Renz

Degussa Corp., Ridgefield Park, NJ, has appointed **Dianna Renz** to the position of Product Manager for Flatting Agents within the Silicas and Chemical Catalysts Division, and **G. Dean Osbourn** to the position of Product Manager for Precipitated Silicas. Both persons will provide marketing and sales support within their division. Ms. Renz is a member of the Philadelphia Society.

Engelhard Corp., Iselin, NJ, has named **Carroll Bennett** to the position of Sales Manager, Coatings and Inks for the United States and Canada in its Pigment and Additives Group. Mr. Bennett is a member of the New York Society.

In addition, **Charles Eggert** has been appointed to Vice President, Marketing and Sales, Specialty Pigments and Additives.

George Schick, retired, former distinguished member of Bell Communications Research Inc.'s technical staff in Morristown, NJ, has received a 1997 American Society for Testing and Materials (ASTM) Award of Merit from ASTM standards-writing Committee G-1 on Corrosion of Metals. Mr. Schick was cited for outstanding contributions to Committee G-1 in soil corrosion, galvanic corrosion, and electrochemical measurements, and for participation in the development of 11 standards and in six interlaboratory test programs.

Ken Stowell has been appointed Vice President Marketing/Sales for D.R. Sperry & Co., North Aurora, IL. Mr. Stowell's duties include developing a representative sales network.

Peter J. Bailey has been named President of Alcoa Industrial Chemicals, Pittsburgh, PA. Mr. Bailey will oversee Alcoa's worldwide industrial chemical man-ufacturing operations and commercial activities in North America, South America, Europe, and Asia.

P.J. Bailey

Eric Percy has been named American Sales Development Consultant for Industrial Copolymers Limited (ICL), Lancashire, UK. Dr. Percy's duties include providing product information and technical training to distributors' sales representatives and their customers. Dr. Percy is a member of the New York Society.

Joseph H. Fuhrman has been appointed President and Chief Executive Officer of Sivento Inc., a Hüls group company, Somerset, NJ. Mr. Fuhrman was most recently Vice President of Hüls' Specialty Chemical Division.

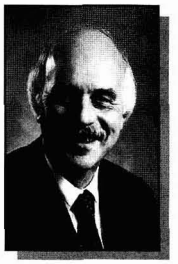
William D. Haig has joined the staff of ANGUS Chemical Co., Buffalo Grove, IL, as Product Manager. Mr. Haig is responsible for product pricing, product quality, and inventory issues in addition to providing support in the areas of strategic planning, contract management, and budgeting.

Sigma Coatings USA, Harvey, LA, has named **Jef Verborgt** President, and **Vernon Noe** Power Industry Manager.

Ace Hardware Corporation's Paint Division, Oak Brook, IL, has appointed **Tyrone Cox** to the position of Southwestern Division Manager. Mr. Cox will assist retailers serviced by Ace's Sacramento and Prescott Valley retail support centers.

Cook Composites and Polymers Company (CCP), Kansas City, MO, has appointed **Charles E. Bennett**, to Chief Executive Officer. Mr. Bennett is the founder of Polymer Products, Inc., Grand Rapids, MI.

Wolfgang Minnerup has been named President and Chief Executive Officer of Creanova Inc., Somerset, NJ. Dr. Minnerup previously served as business controller of Hüls America Inc. He will continue to report to **Klaus Burzin.**



W. Minnerup

Jeff Yoder has been named Manager of the Customer Service and Traffic Departments for Convenience Products, Fenton, MO. Mr. Yoder will supervise customer service personnel and coordinate service/traffic activities for the progressively growing customer base in the consumer DIY, industrial, and home decor industries worldwide.

Witco Corp., Greenwich, CT, has named **Anil N. Parikh** Global Director of Quality. In addition, **Peter J. Biancotti** has been appointed to the position of Vice President of Business Assurance, and **Brian J. Dick** has accepted the position of Vice President - Controller.

C.L. Zimmerman Co., West Chester, OH, has appointed **Rich Gire** to cover sales in the Greater Cincinnati area. Mr. Gire is a member of the Louisville Society.

Day-Glo Color Corp., Cleveland, OH, has appointed **Michael J. Frothingham** to the position of Marketing Manager. Mr. Frothingham will be responsible for new business developments for the company, as well as emerging markets for fluorescent color usage.

Obituary

CDIC Past-President Lew Larson Passes Away

Lewis P. Larson, a member of the CDIC Society, died on January 12, 1998. He was 88 years old.

Mr. Larson was a Past-President (1970) and an Honorary Member of the CDIC Society, and 50-Year Member of the FSCT. He was also a former member of the Board of Directors of the FSCT and served as Chair of the APJ Awards Committee as well as serving on the FSCT's Liaison, and Public Relations Committees. In addition, Mr. Larson was active in the ACS and ASTM, Committee D-1.

A great proponent of education in the coatings industry, Mr. Larson was recently honored as a Distinguished Alumni of North Dakota State University. He also conducted paint and coatings short courses at the University of Missouri-Rolla from 1976-83.

Mr. Larson retired in 1983 from the American Zinc Sales Co., in Columbus, OH.

He is survived by his wife Marion, his son Larry, sister Marie Burkhardt, and grandson and great-granddaughter. The family requests that contributions to his memory be made to the Downtown YMCA, in Columbus, OH.

J. Kalinovich

John Kalinovich has been named Executive Vice President and Chief Operating Officer of Silberline Manufacturing Co., Inc., Hometown, PA. Mr. Kalinovich will be responsible for the development of long range strategic plans and pursuing future growth opportunities.

Gamajet Cleaning Systems, Inc., Malvern, PA, has appointed **Warren F. Geiger** to the position of Vice President of Sales. Mr. Geiger's duties include overseeing the growth and development of an expanding network of manufacturer's representatives throughout North America, as well as monitoring current sales and marketing activities for the company.

Kevin A. Durst has been appointed Treasurer of OM Group, Inc., Cleveland, OH. In this position, Mr. Durst will be responsible for treasury functions.

The American Vacuum Society, New York, NY, has appointed **Steve Rossnagel** as 1998 President-Elect. Dr. Rossnagel is responsible for selecting the Program and Local Arrangements Committee Chairs for the AVS International Symposium to be held during his year of Presidency.

Fitz Chem Corp., Elmhurst, IL, has named **David Crenshaw** to the position of Ink and Adhesives Industry Manager. Mr. Crenshaw will oversee accounts in Illinois, Wisconsin, Indiana and Michigan.

In addition, **Jack Krish** has been named Technical Account Manager. Mr. Krish will handle select accounts in Illinois, Wisconsin, and Minnesota.

The Laser Institute of America, (LIA), Orlando, FL, has elected three officers and 10 board members. **Terry Feeley**, co-founder of Laser Fare, was elected President-Elect, **Jyoti Mazumder** was elected Secretary, and **Florence Oreiro** was elected Treasurer.

Those elected to the board include **Jordan Bajor, Eckhard Beyer, Paul Denney, Larry Dosser, Walt Duley, Craig Friedrich, William Latham, William Lawson, Dewey Sprague** and **Robert Weiner**. Two others, **Dave Farson** and **Lee Blake**, were appointed to the board to fill vacancies.

Radio Frequency Co., Inc., Millis, MA, has named **James K. Plant** as Sales Engineer. Mr. Plant will be responsible for sales and technical service for Macrowave™ RF preheating, curing, and drying systems.

Ernest H. Hirsh has been named President of Cincinnati Industrial Machinery, Cincinnati, OH. In his new position, Mr. Hirsh will oversee a staff of 150 at two manufacturing plants in the U.S. as well as a sales office in Hong Kong.

Literature Review

Surface Coatings, Science and Technology, Second Edition

Edited by:
Paul Swaraj

Published by:
John Wiley & Sons
One Wiley Dr.
Somerset, NJ 08875
1996, xv + 931 pages, $165

Reviewed by: Robert F. Brady, Jr., Washington, D.C.

Those of us who have relied on the first edition of Paul's standard text are pleased to see the appearance of a second edition. This book is a substantial revision and expansion of the 10-year old first edition, and continues to be the best single source for advanced information on coatings ingredients, production, testing, and usage.

The book is divided into nine chapters. Resins are covered in three chapters. The first provides an excellent foundation in the chemistry used to produce polymers for modern coatings; the second covers all major types of binders now used in coatings; and the third provides a cogent and detailed description of waterborne, radiation-cured, powder and high-solids coatings. The sections on epoxy and polyurethane resins are brief (28 pages each), considering their widespread usage in the industry. Discussions of inorganic and organic pigments and pigment dispersion occupy two chapters; both water-based and nonaqueous dispersions are well covered.

The selection of solvents for particular coatings, and the solvency power and evaporation rates of solvents are treated in one chapter. There is no separate chapter on additives, but numerous products used for this purpose are discussed separately throughout the book and the coverage of additives is quite thorough, but scattered. For example, the synthesis and characterization of thixotropic alkyd resins is discussed in Chapter 2, the selection of dispersants and their mechanisms of action are treated in Chapter 5, and driers are covered very well in Chapter 7.

Several principle types of coatings are covered in one short chapter. For each the important objectives, principal resin types, and necessary performance requirements are described. Another brief chapter covers those aspects of surface preparation and paint application which are important to the formulator. A very extensive and thorough chapter is devoted to paint properties and their evaluation. Theoretical aspects of, and practical methods for the evaluation of all major coatings properties are discussed.

The book is sturdily printed and bound. Each chapter contains an extensive list of references to the worldwide scientific and patent literature; references extend from 1922 to 1993, with the bulk being after 1970. Many clear line figures are provided, especially in the section on paint testing. There is a thorough subject index, but no index of referenced authors.

This book is the most comprehensive professional reference available today, for it provides a detailed overview of all important aspects of coatings technology. It is best suited for an advanced text in a graduate coatings course or as a reference for the experienced chemist who formulates coatings or supplies raw materials to the industry. The reader needs to bring some knowledge of coatings chemistry to this book, but will be amply rewarded with all encompassing and substantial discussions of modern coatings technology.

New Products

Books/ Publications

Paint and Coatings Forecast

The National Paint and Coatings Association's *new Paint and Coatings "2000": Review and Forecast (Second Edition)* is now available. This comprehensive report offers updated market data, including a quantitative review and projection of technological and regulatory changes, as well as forecasts and growth rates to the year 2002. This edition is illustrated with graphs and charts for easy reading.

Circle No. 30 on Reader Service Card

Fluorescent Color Design Guide

Day-Glo Color Corp. has introduced a fluorescent color design guide to aid designers and marketers in utilizing Day-Glo's color palette. Written in five sections, the guide contains tips on creative and digital design, as well as providing support and technical assistance information. The guide was produced using four-color process printing as well as up to six different Day-Glo printing inks.

Circle No. 31 on Reader Service Card

Measurement Services

A four-page brochure describing comprehensive laboratory measurement services has been published by Labsphere's Reflectance Research Laboratory. Reflectance, transmittance and calorimetric measurement services are available in the UV-VIS-NIR and MIR-FIR wavelength ranges on a per piece or contract basis.

Circle No. 00 on Reader Service Card

Architectural Painting

The Master Painters Institute has released the *Architectural Painting Specification Manual* describing types of substrates encountered in architectural painting. Physical properties of the substrate, surface preparation techniques for original and repaint work as well as all suitable painting systems are described in detail. This 85-page manual contains information such as wood types, effects of temperature, humidity, and spreading rate charts. Manuals can be customized geographically to include lists of product names and suppliers in that area.

Circle No. 49 on Reader Service Card

Filtration Products Catalog

Parker Hannifin has released a full-color, 140 page reference catalog featuring photos, product descriptions, applications, specifications, and ordering information on their line of filtration media and vessels. The catalog contains an expanded appendix of conversion tables, a compatibility guide, and a glossary of filtration terminology.

Circle No. 32 on Reader Service Card

Filter Press Spec. Sheet

D.R. Sperry & Co. is offering a two-page specification sheet on its model 1200mm filter press. The literature highlights the filtering unit's features such as its plate shifting mechanism, washing system, cloth shaker, drip tray, and electro hydraulic controls and operation of the machine.

Circle No. 33 on Reader Service Card

Aluminum Coatings

Published by the Roof Coatings Manufacturers Association, a Tech-Note on *Recommendations for the Application of Aluminum Coatings* is available. Specifics covered in the Tech-Note include weather conditions, surface conditions, application, coverage, and after application details.

Circle No. 34 on Reader Service Card

Bonding Tape

The 3M Industrial Tape and Specialties Division has published a four-page color brochure illustrating how its acrylic pressure-sensitive Bonding Tape 9245 is reportedly effective in various industries and applications. The brochure's back cover is a fax-back page, allowing customers to outline their requirements and obtain technical assistance.

Circle No. 35 on Reader Service Card

Lab Equipment Catalog

Cannon Instrument Co.'s 1998-99 catalog, "Laboratory Equipment for Viscosity Measurement," contains products used for determining the viscosity of paints and coatings, such as the ETS-1000 electronic Thomas-Stormer viscometer, the Cannon 2000 Series rotational viscometer, and various types of glass capillary viscometers.

Circle No. 36 on Reader Service Card

Paints/ Coatings

Ceramic Coating

A new line of high temperature refractory ceramic paints has been introduced by ZYP Coatings for protecting header, header clamps and manifolds on high performance cars, airplanes, and motorcycles. Codemark is a water-based 2000 °F paint of high temperature insulating ceramic pigments.

Circle No. 37 on Reader Service Card

Mold Coating

"O" Voc is a flexible in-mold coating used to decorate and protect polyurethane integral skin molded products. This coating's features include high-coverage, low odor, ultraviolet protection, water clean-up, and environmental compliance. It is available in black, white, and custom matched colors through Waterlac Coatings, Inc.

Circle No. 38 on Reader Service Card

Ship Hull Paint

The Monopol Group has introduced Biomarine, an environmentally friendly antifouling paint used to protect the bottoms of ships against living organisms that attach themselves to the hull. Available in blue, red, black, green, and offwhite, as well as in a fluorescent version for safety on sailboats, the paint reportedly repels micro-organisms without killing or intoxicating them.

Circle No. 39 on Reader Service Card

Raw Materials

Nonionic Surfactant

A new data sheet entitled, "Surfynol® TG Nonionic Surfactant," is now available from Air Products and Chemicals, Inc. The publication highlights the surfactant as a low foaming, nonionic wetting agent for pigment and substrate wetting in aqueous systems.

Circle No. 40 on Reader Service Card

Raw Material Brochure

Creanova has published a tri-fold brochure featuring information on raw materials for use in resins, coatings, sealants, adhesives and elastomers. The brochure focuses on diisocyanates for polyure-

thanes, diamines to be used in epoxy hardeners, and polyisocyanate powder coating crosslinkers and epoxy powder gloss control agents. A brief description and suggested uses of the products are also included in the brochure.

Circle No. 41 on Reader Service Card

Grinding Beads

Low-wearing "Generation II" QBZ-64 zirconium silicate grinding beads have been released. Available through the Quackenbush Co., Inc., the beads are designed for increased bead life and less mill wear.

Circle No. 42 on Reader Service Card

Regalite® Resins

Hercules Incorporated has launched three new water-white hydrogenated hydrocarbon resins, Regalite V1100, V1120 and T1140. The resins are to be used for adhesives applications such as packaging, glue sticks and non-wovens, and for use in sealants and polymer modification. They reportedly have little odor, good color stability, and resistance to thermal and oxidative degradation.

Circle No. 43 on Reader Service Card

Laboratory Apparatus

Laser Ablation Accessory

The LSX-200, a UV laser ablation accessory for determining trace metals in solids by ICP-MS and ICP-ES, is now available from CETAC Technologies. Principle features of the system include TEM_{00} flat laser beam profile, compact benchtop design, micro analysis with less than 10 um spot size, and improved Windows™ software control.

Circle No. 44 on Reader Service Card

Photoelectric Sensor

The Model 7692A sensor from Automatic Timing & Controls is a short-range, compact photoelectric sensor suited to applications where reliable detection of light or objects with varying color, contrast, and texture is required. The sensor works over a 10 to 30 Vdc power supply range, and has a two-wire, 120 mA FET output.

Circle No. 45 on Reader Service Card

Reflectance Kit

The Attenuated Total Reflectance Kit (ARK) can be used for analyzing both aqueous and non-aqueous liquids and solids. The ARK features complete purge capabilities, tool-free alignment, and a standard 45∞ zinc selenide crystal plate. It is available from Spectra-Tech in three formats: ARK Trough Plate Kit, ARK Flat Plate Kit, and ARK Combination Kit.

Circle No. 46 on Reader Service Card

Accelerometer

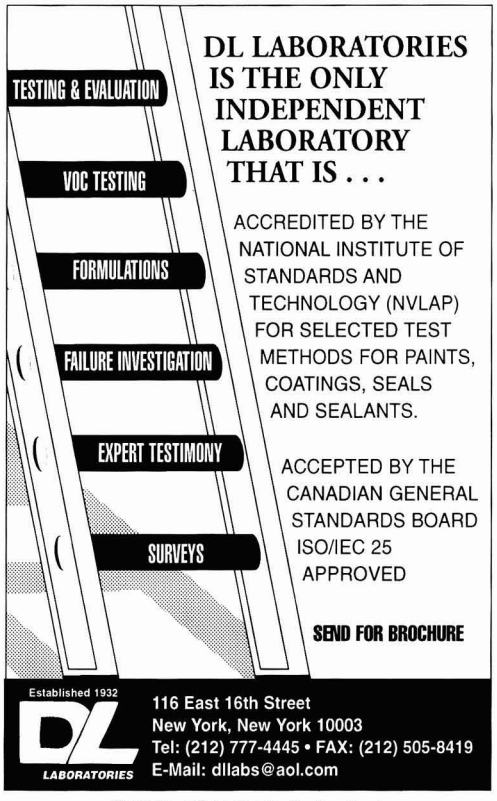
Computational Systems, Inc. introduces an accelerometer for machine repairs with a drip-proof boot and 15 feet of cable made of polyurethane. CSI offers two versions: a permanent epoxy-mount and a removable screw-mount.

Circle No. 47 on Reader Service Card

Data Logger

Telatemp Corp. has introduced the Micro 8000 which can reportedly record up to 8,000+ time-stamped temperature measurements in a variety of applications. It is compact (0.6" x 1.5" x 2.13") and operates on a 3.6 volt battery.

Circle No. 48 on Reader Service Card



Circle No. 150 on Reader Service Card

Circle No. 265 on Reader Service Card

Calendar of Events

Federation Meetings

For information on FSCT meetings, contact Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422 (610) 940-0777, FAX: (610) 940-0292. Web site: http://www.coatingstech.org

1998

(Apr. 15-17)—ICE Latinoamerica '98. Miami Beach Convention Center, Miami, FL.

(April 25-26)—FSCT Spring Board of Directors Meeting. April 25— Executive Committee Meeting; April 26—Board Meeting. Renaissance Cleveland Hotel, Cleveland, OH.

(May 14-15)—FSCT Incoming Society Officers Meeting. May 14—FSCT Headquarters Visit; May 15—Meeting, Park Ridge Hotel and Conference Center, King of Prussia, PA.

(July 23-24)—Pan-American Coatings Expo. World Trade Center, Mexico City, Mexico.

(Oct. 14-16)—ICE '98—FSCT Annual Meeting and International Coatings Expo and Technology Conference. Ernest N. Morial Convention Center, New Orleans, LA.

1999

(Oct. 20-22)—ICE '99—FSCT Annual Meeting and International Coatings Expo and Technology Conference. Dallas, TX.

Special Society Meetings

1998

(Mar. 17)—Kansas City Society's Technical Symposium. Harrah's Hotel and Conference Center, North Kansas City, MO. (Yasmin Sayed-Sweet, CCP, P.O. Box 419389, Kansas City, MO 64141-6389; (816) 391-6190; or Dave Hazlett, Tnemec Co., Inc., 123 W. 23rd Ave., North Kansas City, MO 64116; (816) 474-3400.

(Mar. 25-27)—"New Nuts and Bolts to Keep Your Brushes Rolling." 55th Southwestern Paint Convention. Co-sponsored by the Dallas and Houston Societies. Del Lago Resort and Convention Center, Conroe, TX. (Eric Stoeber, c/o Ribelin Sales Inc., 7786 Blankenship Dr., Houston, TX 77055; (713) 688-7722).

(Mar. 30-Apr. 1)—Southern Society Annual Meeting. Marriott Grand Hotel, Point Clear, AL.

(April 15)—"Spectrum of Coatings." Symposium sponsored by the Louisville Society. Executive West Hotel, Louisville, KY. (Ilona Nemes-Duvall, Red Spot Paint and Varnish, 1107 E. Louisiana St., 47711; (812) 467-2337).

(April 21)—"Innovative Coatings: Practical Solutions for Global Demands." 23rd Annual FOCUS Conference sponsored by the Detroit Society. Michigan State University Management Education Center, Troy, MI. (Rosemary Brady, Akzo Nobel Coatings Inc., P.O. Box 7062, Troy, MI 48007-7062).

(April 22)—"Manufacturing Symposium." Co-sponsored by the Cleveland Society and the Pittsburgh Society. (James Currie, Jamestown Paint Co., 108 Main St., P.O. Box 157, Jamestown, PA 16134; 412-932-3101).

(April 23-24)—"Waterborne Coatings: Sink or Swim II." 41st Annual Technical Symposium. Co-sponsored by the Cleveland Society and the Pittsburgh Society. (Vicki Fisher, Jamestown Paint Co., 108 Main St., P.O. Box 157, Jamestown, PA 16134; 412-932-3101).

(May 1-2)—"Maximizing Performance Properties and Minimizing Production Problems of Waterborne Coatings." 51st Annual Technical Symposium. Sponsored by the Pacific Northwest Society. Doubletree Inn at the Quay, Vancouver, WA. (Debra Severson, Miller Paint Co., 12730 NE Whitaker Way, Portland, OR 97230; 503-255-0190).

(May 11-14)—Eastern Training Conference II and Show. Sponsored by the Philadelphia Society. Valley Forge Convention Center, King of Prussia, PA. (Wayne Kraus, Hercules Incorporated, Research Center, 500 Hercules Rd., Wilmington, DE 19808; (302) 995-3435).

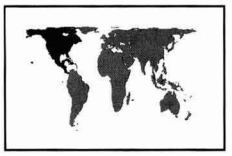
(June 5-6)—Joint Meeting of the St. Louis and Kansas City Societies. Lake of the Ozarks, MO.

1999

(Feb. 16-18)—24th Biennial Western Coatings Societies' Symposium and Show. Sponsored by the Golden Gate, Los Angeles, Pacific Northwest, and Rocky Mountain Societies. John Ascuaga's Nugget, Sparks, NV.

(April 13-16)—Southern Society Annual Meeting. Hyatt Regency Hotel, Savannah, GA. (Dale Kenknight, Akzo Nobel Coatings, Inc., 6369 Old Peachtree Rd., Norcross, GA 30071-1780).

Other Organizations



1998—North America

(Mar. 1-4)—"Zinc: Protecting Your Future." Conference sponsored by the American Zinc Association. PGA National Resort and Spa, Palm Beach Gardens, FL. (American Zinc Association, Ste. 240, 1112 16th St., N.W., Washington, D.C. 20036).

(Mar. 2-4)—"International Seminar on the Technology of Inherently Conductive Polymers." Short course sponsored by Advanced Polymer Courses. Crown Plaza Resort, Hilton Head Island, SC. (M. Aldissi, Advanced Polymer Courses, 6 Striper Lane, E. Falmouth, MA 02536).

(Mar. 2-4)—"Polymer Stabilizers and Modifiers '98." Conference and Exhibition sponsored by The Institute of Materials Science. Hilton Head Island, SC. (Angelos V. Patsis, The Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Mar. 8-12)—"AIChE Spring National Meeting/Petrochem and Technochem '98." Sponsored by the American Institute of Chemical Engineers (AIChE). Sheraton New Orleans, New Orleans, LA. (AIChE, 345 E. 47th St., New York, NY 10017).

(Mar. 9-11)—"Introduction to Emulsion Polymers/Polymer Colloids." Conference sponsored by The Institute of Materials Science. Hilton Head Island, SC. (Angelos V. Patsis, The Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Mar. 9-12)—"Pigment Dispersion: Science and Technology." Conference sponsored by The Institute of Materials Science. Hilton Head Island, SC. (Angelos V. Patsis, The Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(Mar. 9-12)—"Introduction to Coatings Science." Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(Mar. 9-12)—"Practical Emulsion Polymerization Technology." Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(Mar. 16-17)—"Understanding Microbial and Chemical Contaminants in Buildings." Seminar sponsored by Air Quality Sciences, Inc. Atlanta, GA. (Pam Lackey, Air Quality Sciences, Inc., 1337 Capital Circle, Atlanta, GA 30067).

(Mar. 17)—Kansas City Society's Technical Symposium. Harrah's Hotel and Conference Center, North Kansas City, MO. (Yasmin Sayed-Sweet, CCP, P.O. Box 419389, Kansas City, MO 64141-6389; (816) 391-6190; or Dave Hazlett, Tnemec Co., Inc., 123 W. 23rd Ave., North Kansas City, MO 64116; (816) 474-3400.

(Mar. 22-25)—Spring Convention. Sponsored by The Adhesive and Sealant Council, Inc. Buena Vista Palace, Orlando, FL. (The Adhesive and Sealant Council, Inc., 1627 K St., N.W., Ste. 1000, Washington, D.C. 20006).

(Mar. 22-26)—NPCA Spring Meeting and Architectural and Industrial Coatings Committee Meeting. Sponsored by the National Paint and Coatings Association (NPCA). Boca Raton Resort & Club, Boca Raton, FL. (Dorothy Brawner, NPCA, 1500 Rhode Island Ave., Washington, D.C. 20005-5597).

(Mar. 22-27)—"Corrosion/98." Sponsored by NACE International. San Diego Convention Center, San Diego, CA. (NACE International, P.O. Box 218340, Houston, TX 77218-8340).

(Mar. 23-27)—"Basic Composition of Coatings." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (UMR Coatings Institute, 236 Schrenk Hall, 1870 Miner Circle, Rolla, MO 65409).

(Mar. 23-27)—19th Annual Equipment Exhibition. Sponsored by the Northern California Chapter of the American Vacuum Society. San Jose, CA. (Margaret Stringer, AVS, 120 Wall St., 32nd Floor, New York, NY 10005).

(Mar. 24-26)—"Silicones in Coatings II." Sponsored by The Paint Research Association. Disney World Village, Orlando, FL. (Dip Dasgupta, Paint Research Association, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD United Kingdom).

(Mar. 25-27)—"New Nuts and Bolts to Keep Your Brushes Rolling." 55th Southwestern Paint Convention. Co-sponsored by the Dallas and Houston Societies. Del Lago Resort and Convention Center, Conroe, TX. (Eric Stoeber, c/o Ribelin Sales Inc., 7786 Blankenship Dr., Houston, TX 77055; (713) 688-7722).

(Mar. 30-Apr. 1)—Southern Society Annual Meeting. Marriott Grand Hotel, Point Clear, AL.

(Mar. 31-Apr. 1)—Hazardous Materials Training Seminar. Sponsored by the National Paint and Coatings Association (NPCA). Chicago, IL. (Dorothy Brawner, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005-5597).

(Apr. 14-17)—"Introduction to Coatings Technology." Short course sponsored by Kent State University. Kent, OH. (Carl J. Knauss, Director, Professional Development Institute, P.O. Box 1792, Kent, OH 44240).

(April 15)—"Spectrum of Coatings." Symposium sponsored by the Louisville Society. Executive West Hotel, Louisville, KY. (Ilona Nemes-Duvall, Red Spot Paint and Varnish, 1107 E. Louisiana St., 47711; (812) 467-2337).

(Apr. 18-19)—"Water Problems in Building Exterior Walls: Evaluation, Prevention, and Repair." Symposium sponsored by the American Society for Testing and Materials (ASTM) Committee E-6. Atlanta Hilton and Towers, Atlanta, GA. (ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959).

(Apr. 18-23)—"Vacuum Coating Manufacturing and Technology Issues." 41st Technical Conference. Sponsored by the Society of Vacuum Coaters. The Westin Hotel, Copley Place, Boston, MA. (Society of Vacuum Coaters, 440 Live Oak Loop, Albuquerque, NM 87122).

(Apr. 19-22)—RadTech '98 North America Conference. Sponsored by RadTech International North America. Hyatt Regency, Chicago, IL. (RadTech International North America, 60 Revere Dr., Ste. 500, Northbrook, IL 60062).

(Apr. 20-22)—ASTM Committee B-8 on Metallic and Inorganic Coatings. Sponsored by the American Society for Testing and Materials. West Conshohocken, PA. (ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428.

(Apr. 20-24)—"Applied Rheology for Industrial Chemists." Short course sponsored by Kent State University. Kent, OH. (Carl J. Knauss, Director, Professional Development Institute, P.O. Box 1792, Kent, OH 44240).

(Apr. 20-24)—"Introduction to Paint Formulation." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409).

(April 21)—"Innovative Coatings: Practical Solutions for Global Demands." 23rd Annual FOCUS Conference sponsored by the Detroit Society. Michigan State University Management Education Center, Troy, MI. (Rosemary Brady, Akzo Nobel Coatings Inc., P.O. Box 7062, Troy, MI 48007-7062).

(Apr. 21-24)—"Coverings." Exhibition organized by TSI, Inc. Orange County Convention Center, Orlando, FL. (TSI, Inc., 900 E. Indiantown Rd., Ste. 207, Jupiter, FL 33477).

(Apr. 22)—"Manufacturing Symposium." Co-sponsored by the Cleveland Society for Coatings Technology and the Pittsburgh Society for Coatings Technology. (James Currie, Jamestown Paint Co., 108 Main St., P.O. Box 157, Jamestown, PA 16134; 412-932-3101).

(Apr. 23-24)—"Protection of Materials and Structures from the LEO Space Environment." Conference sponsored by Canadian Space Agency and University of Toronto Institute for Aerospace Studies. (J.I. Kleiman, Institute for Aerospace Studies, 4925 Dufferin St., Downsview, Ontario, Canada M3H 5T6).

(Apr. 23-24)—"Waterborne Coatings: Sink or Swim II." 41st Annual Technical Symposium. Co-sponsored by the Cleveland Society for Coatings Technology and the Pittsburgh Society for Coatings Technology. (Vicki Fisher, Jamestown Paint Co., 108 Main St., P.O. Box 157, Jamestown, PA 16134; 412-932-3101).

(Apr. 27-29)—"Making Life Easier for the Epoxy Formulator—Technical Solutions." Conference sponsored The Society of the Plastics Industry Inc.'s Epoxy Resin Formulators Division. The Ritz-Carlton Kempinski, Montreal, Canada. (Tina Kierzek, SPI Epoxy Resin Formulators Div., Ste. 600K, 1801 K St., N.W., Washington, D.C. 20006-1301).

(Apr. 28-29)—44th Annual Technical Meeting of the Institute of Environmental Sciences and Technology. Phoenix Civic Plaza, Phoenix, AZ. (Institute of Environmental Sciences and Technology, 940 East Northwest Hwy., Mount Prospect, IL 60056-3422).

(Apr. 28-29)—Hazardous Materials Training Seminar. Sponsored by the National Paint and Coatings Association (NPCA). Baltimore, MD. (Dorothy Brawner, NPCA, 1500 Rhode Island Ave., Washington, D.C. 20005-5597).

(May 1-2)—51st Annual Technical Symposium. Sponsored by the Pacific Northwest Society for Coatings Technology. Doubletree Inn at the Quay, Vancouver, WA. (Debra Severson, Miller Paint Co., 12730 NE Whitaker Way, Portland, OR 97230; 503-255-0190).

(May 4-6)—"Adhesion and Coatings Adhesion: Theory , Applications, and Durability." Conference sponsored by The Institute of Materials Science. Orlando, FL. (Angelos V. Patsis, The Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(May 4-8)—"Adhesion Principles and Practice for Coatings and Polymer Scientists." Short course sponsored by Kent State University. Kent, OH. (Carl J. Knauss, Director, Professional Development Institute, P.O. Box 1792, Kent, OH 44240).

(May 5-6)—"Effects of Surface Finish on Corrosion Testing." Symposium sponsored by the American Society for Testing and Materials (ASTM). Atlanta Hilton, Atlanta, GA. (Bob Held, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959).

(May 6-8)—ASTM Committee G-1 on Corrosion of Metals. Sponsored by the American Society for Testing and Materials (ASTM). Atlanta Hilton, Atlanta, GA. (Bob Held, ASTM, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959).

(May 11-14)—AVS short course program sponsored by the Arizona Chapter of the American Vacuum Society. Phoenix, AZ. (Margaret Stringer, AVS, 120 Wall St., 32nd Floor, New York, NY 10005).

(May 11-14)—Eastern Training Conference II and Show. Sponsored by the Philadelphia Society. Valley Forge Convention Center, King of Prussia, PA. (Wayne Kraus, Hercules Incorporated, Research Center, 500 Hercules Rd., Wilmington, DE 19808; (302) 995-3435).

(May 11-14)—"Introduction to Powder Coatings Technology." Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(May 11-15)—"Interpretation of IR and Raman Spectroscopy." Short course sponsored by The Fisk Infrared Institute. Vanderbilt University, Nashville, Tennessee. (Clara Craver, The Fisk Infrared Institute, 1000 17th Ave., N., Nashville, TN 37208).

(May 11-15)—"Dispersion of Pigments and Resins in Fluid Media." Short course sponsored by Kent State University. Kent, OH. (Carl J. Knauss, Director, Professional Development Institute, P.O. Box 1792, Kent, OH 44240).

(May 13-15)—"Spray Finishing Technology Workshop." Sponsored by Bowling Green State University and ITW DeVilbiss. Toledo, OH. (Richard A. Kruppa, Bowling Green State University, Bowling Green, OH 43403).

(May 17-20)—1998 Fluid Controls Institute Annual Meeting. The Cloister, Sea Island, GA. (Fluid Controls Institute, Inc., 1300 Summer Ave., Cleveland, OH 44115-2851).

(May 18-21)—"Coatings Science for Coatings Technicians." Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(May 18-22)—"Physical Testing of Paints and Coatings." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (UMR Coatings Institute, 236 Schrenk Hall, 1870 Miner Circle, Rolla, MO 65409).

(June 1-3)—"Colorimetry and Color Measurement." Short course sponsored by Rochester Institute of Technology's Munsell Color Science Laboratory. Rochester, NY. (Colleen M. Desimone, RIT Munsell Color Science Laboratory, 54 Lomb Memorial Dr., Rochester, NY 14623-5604).

(June 1-5)—"Advances in Emulsion Polymerization and Latex Technology." Short course sponsored by Lehigh University. Emulsion Polymers Institute, Bethlehem, PA. (Mohamed S. El-Aasser, Emulsion Polymers Institute, Lehigh University, 111 Research Dr., Bethlehem, PA 18015).

(June 4)—"Instrumental Color Matching." Short course sponsored by Rochester Institute of Technology's Munsell Color Science Laboratory. Rochester, NY. (Colleen M. Desimone, RIT Munsell Color Science Laboratory, 54 Lomb Memorial Dr., Rochester, NY 14623-5604).

(June 5-6)—Joint Meeting of the St. Louis and Kansas City Societies. Lake of the Ozarks, MO.

(June 8-12)—"Introduction to Paint Formulation." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (UMR Coatings Institute, 1870 Miner Circle, Rolla, MO 65409).

(June 8-12)—"Foundations of Color Management Systems." Short course sponsored by Rochester Institute of Technology's Munsell Color Science Laboratory. Rochester, NY. (Colleen M. Desimone, RIT Munsell Color Science Laboratory, 54 Lomb Memorial Dr., Rochester, NY 14623-5604).

(June 9)—ASTM D01.51 on Powder Coatings. Sponsored by the American Society for Testing and Materials (ASTM). Omni Inner Harbor Hotel, Baltimore, MD. (Jeffrey Hagerlin, O'Brien Powder Products, 9800 Genard Rd., Houston, TX 77041-7624).

(June 9-11)—1998 Department of Defense-Industry Aerospace Coatings Conference. Renaissance Waverly Hotel, Atlanta, GA. (Omar Deel or Rick Wolterman, Battelle, 505 King Ave., Columbus, OH 43201-2693).

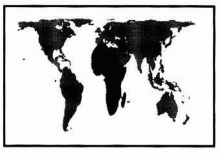
(June 9-11)—Automotive Finishing '98. Conference and Exposition sponsored by the Society of Manufacturing Engineers. Cobo Conference and Exhibition Center, Detroit, MI. (SME, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930).

(June 15-18)—"Coatings Science for Coatings Formulators." Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

(June 22-25)—"Coatings Science for Coatings Chemists." Short course sponsored by The University of Southern Mississippi. Hattiesburg, MS. (Shelby F. Thames or Debbie Ballard, The University of Southern Mississippi, Box 10037, Hattiesburg, MS 39406-0037).

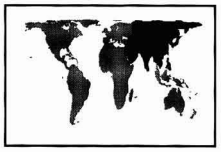
(July 13-15)—"Basic Coatings for Sales, Marketing, and General Personnel." Short course sponsored by University of Missouri-Rolla (UMR), St. Louis, MO. (UMR Coatings Institute, 236 Schrenk Hall, 1870 Miner Circle, Rolla, MO 65409).

1998—Africa



(Mar. 6-8)—"Coatings for Africa '98." Sponsored by The Oil & Colour Chemists' Association's (OCCA) South African Division, the Natal Section, and Surfex Ltd. International Convention Centre, Durban, South Africa. (Christopher Pacey-Day, OCCA, 967 Harrow Rd., Wembley, Middlesex, England HA0 2SF).

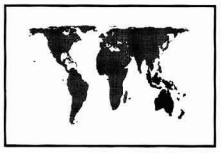
1998—Asia



(May 12-14)—Techno Trade '98. Sponsored by Singapore Confederation of Industries, Taiwan Association of Machinery Industry, and Taiwan Industrial Fasteners Institute. World Trade Center, Singapore. (Interfama Brooks Exhibitions Pte. Ltd., Forum Place, Hatfield, Hertfordshire AL1O ORN, United Kingdom).

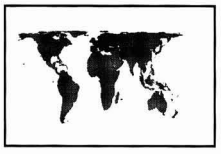
(May 26-30)—SPI/DOC Product Literature Center and the Gold Key Program. Sponsored by The Society of the Plastics Industry, Inc. (SPI) and the U.S. Department of Commerce. Guangdong Province, China. (SPI, Ste. 600K, 1801 K St., N.W., Washington, D.C. 20006).

1998—Australia



(July 29-Aug. 1)—"Coatings for the Future." Second Trans Tasman Surface Coatings Conference. Co-sponsored by Surface Coatings Association, New Zealand, Inc., and Surface Coatings Association, Australia, Inc. The Carlton Hotel, Auckland, New Zealand. (98 Transtas Conference, P.O. Box 5192, Wellesley St., Auckland, New Zealand).

1998—Europe



(Mar. 10-11)—"Coatings for Wood." Training course sponsored by the Paint Research Association. Teddington, Middlesex, United Kingdom. (Heena Mehta, PRA, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD United Kingdom).

(Mar. 30-Apr. 1)—"Radiation Curing Technology." Training course sponsored by the Paint Research Association. Teddington, Middlesex, United Kingdom. (Heena Mehta, PRA, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD United Kingdom).

(Apr. 1-3)—PCE '98. Conference and exhibition sponsored by the Journal Protective Coatings Europe (PCE). The Netherlands Congress Centre, The Hague, The Netherlands. (PCE '98, 2100 Wharton St., Ste. 310, Pittsburgh, PA 15203-1951).

(Apr. 20-25)—Hannover Fair '98: World Center for Industrial Technology. Hannover Fairgrounds, Hannover, Germany. (Andrea Anderson, Hannover Fairs USA, Inc., 103 Carnegie Center, Princeton, NJ 08540).

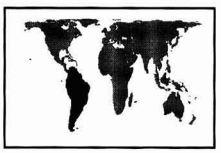
(Apr. 23)—"What is Paint?" Training course sponsored by the Paint Research Association. Teddington, Middlesex, United Kingdom. (Heena Mehta, PRA, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD United Kingdom).

(Apr. 27-29)—"Colour Measurement and Colour Control." Training course sponsored by the Paint Research Association. Teddington, Middlesex, United Kingdom. (Heena Mehta, PRA, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD United Kingdom).

(May 25-27)—11th International Symposium on Polymer Analysis and Characterization (ISPAC-11). Santa Margherita Ligure, Genoa, Italy. (Oscar Chiantore, Dept. of Chemistry IPM, University of Torino, Via Giuria 7-101025 Torino, Italy; Fax: +39 11 670 7855).

(June 22-24)—"SURFEX '98." Sponsored by The Oil & Colour Chemists' Association (OCCA). Harrogate, England. (Christopher Pacey-Day, OCCA, 967 Harrow Rd., Wembley, Middlesex, England HA0 2SF).

1998—South America



(Apr. 15-17)—ICE Latinoamerica '98. Miami Beach Convention Center, Miami, FL. (Lisa McGlashen, FSCT, 492 Norristown Rd., Blue Bell, PA 19422; (610) 940-0777, FAX: (610) 940-0292. http://www.coatingstech.org).

Classifieds

Address all classified orders to: Classified Department, JOURNAL OF COATINGS TECHNOLOGY, 492 Norristown Rd., Blue Bell, PA 19422; FAX: (610) 940-0292. For information on closing dates, please call (610) 940-0777.

RATES

$50.00 per column inch. Available in half-inch increments up to 4 1/2 column inches. Larger units are available at regular display ad rates. Total number of characters per line is 40, eight lines per inch, column width: 2 1/4 in. Box numbers available. Replies forwarded via USPS at no extra charge. Classified ads are not subject to agency commission. Copy will be set as submitted.

QUALITY USED LAB EQUIPMENT

Brookfield Digital Viscosity Meters
Stormer Viscosity Meters
Testing Ovens (Various Brands)
Lab Air Mixers
Perkin-Elmer Gas Chromatograph
CB Lab Sand Mill
BP Lab Sigma Blade Mixer

Check out our Web Site www.westernequipco.com
WESTERN EQUIPMENT CO.
(510) 638-2774 • Fax: (510) 632-5928

USED EQUIPMENT

Dispersers, Media Mills, Mixers, Ribbon Blenders, Ball & Pebble Mills, Reactors, Fillers & Labelers, Stainless Steel Storage & Batch Tanks

CALL WITH YOUR LIST OF SURPLUS EQUIPMENT!

SOUTHWEST PROCESS EQUIPMENT, INC.
Phone: (713) 223-1238 • Fax: (713) 225-1942
Web Site: www.southwesttrading.com

HELP WANTED

Career Opportunities Nationwide

Career Opportunities Nationwide: We have the finest opportunities available with Fortune 100 companies as well as smaller firms. If you have experience in coatings, thin-films, vacuum technology, resins, polymers, etc., then send your resume in confidence. We have hundreds of openings currently available to you in all industries: optical, manufacturing, defense, semiconductors, etc. Same day response for qualified applicants. Visit our website at **www.ansara.com** or e-mail resume to: **pk@ansara.com.** Send to: Mr. Peter Kratimenos, P.O. Box 239, West Springfield, MA 01090. Tel: 413-733-0791 ext. 14 or FAX: **413-731-1208**. Never a fee.

HELP WANTED

National Sales Manager—Coatings

Specialty Coatings Company seeks a professional to develop National Accounts programs for retail distribution. Similar experience is required.

Excellent earnings potential, flexible on location. FT/PT or consulting option.

CONTACT:
Denise Gonzalez, Consultant, FCI
(732) 576-8522
(888) 324-3303
Fax: (732) 576-8098

Advertisers' Index

NOTE: The Advertisers' Index is published for the convenience of our readers and as an additional service to our advertisers. The publisher assumes no liability for errors or omissions.

Humbug from Hillman

I very much appreciated Jeff Sturm's thoughtful letter and the inclusion of yet another *Yetter Letter* which will give me fodder for a couple of issues. November's letter included:

➥Everyone knows that exercise is good for you, but here are some you'd be better off without:

—Running around in circles
—Pushing your luck
—Spinning your wheels
—Climbing the walls
—Beating your own drum
—Jumping to conclusions
—Fishing for compliments
—Passing the buck
—Jumping on the bandwagon

➥Teacher says, "Not only is he the worst behaved child in the school, he has a perfect attendance record."

➥Ted Green, coach of the Edmonton Oilers (hockey team), when told that a player had suffered a concussion and didn't know who he was, responded, "Good, tell him he's Wayne Gretzky."

—O'Brien in *Sports Illustrated*

➥Racehorse owner E.R. Bradley had all his horses' names begin with the letter B, including one called Bad News. When someone asked why he gave the horse a name with such a negative connotation, Bradley explained, "Bad News travels fast."

➥There are worse things than getting a call for a wrong number at 4 a.m. It could be the right number.

♠ ♥ ♠ ♥ ♠ ♥ ♠ ♥ ♠

It was so nice, as well, to receive Marv Schnall's note and his contributions from his son's "web page," a few of which follow.

—Did you hear about the restaurant on the moon? The food's great, there's just no atmosphere.

—Q. What do you get when you cross an insomniac, an agnostic, and a dyslexic? A. Someone who stays up late at night pondering the existence of Dog.

—Q. What did the Dalai Lama say to the hot dog vendor? A. Make me one with everything.

—Times were tough for Marcus Welby, M.D., so he decided to rent out some of his property. He proceeded to rent his garage to Midas Mufflers and some office space to the Poland Springs bottled water company, prompting him to hang up a sign reading: Midas-Welby-Spring. (For this they go to outer cyber space?)

♠ ♥ ♠ ♥ ♠ ♥ ♠ ♥ ♠

From my "get to it some time" file, I found a May letter from Sid Lauren, which said in part:

In the weekly feature "Metropolitan Diary" in the *New York Times*, a reader reported that he was in Penn Station to purchase a ticket when he heard this from a woman at the immediately adjacent window: "Is it your job," she asked the man behind the window, "to sell me a ticket to anywhere I want to go?"

"Yes, ma'am," he replied. "Where would you like to go?"

"To hell and back," she answered without a smile.

Without batting an eye, the ticket agent, with the utmost courtesy, consulted his computer screen and said, "Sorry, ma'am, but that train is completely sold out."

♠ ♥ ♠ ♥ ♠ ♥ ♠ ♥ ♠

It frequently happens that I receive the same story from two or more sources. This time it has to do with punch lines. Recently, old reliable Dick Kiefer sent me a rather long way of getting there and the next day my dear friend, Julius Nemeth, arrived at the same punch line but by a more direct route. Here's Julius' shorter version:

The roof was leaking and the old monastery needed other repairs. The friars were out of money and they decided to go into the flower business to make ends meet. They were very successful, and soon the town florist was begging them to stop. They went on selling flowers and the florist talked his friend, Hugh, into trying to persuade the friars to quit the florist business.

The eloquent Hugh was successful, and the florist's business was saved.

The moral of the story is that Hugh and only Hugh can prevent florist friars!

(If I get five requests (none from Kiefer) I will publish Kiefer's version.)

♠ ♥ ♠ ♥ ♠ ♥ ♠ ♥ ♠

Blame this on Dick Kiefer, as well: A city slicker moves to the country and decides he'll start farming. He goes to the local co-op and tells the man, "Give me 100 baby chicks." The co-op man complies. A week later the man returns and says, "Give me 200 baby chicks."

"Wow!" the co-op man replies. "You must be doing well."

"Naw," said the man with a sigh. "I'm either planting them too deep or too far apart!"

♠ ♥ ♠ ♥ ♠ ♥ ♠ ♥ ♠

Bob Athey returns with: "You've been a pretty sick man," said the doctor. "In fact, I might say that it was only your strong determination and constitution that pulled you through."

"Well," responded the convalescent, somewhat testily, "I trust that you will remember that when you come to make out your bill."

Dorothy Feigl writes that she was momentarily stunned by the headline "Jar of Barbicide Given to the Smithsonian Museum," (*C&EN*, July 14). "My immediate thought," she says, "was that Dr. Kervorkian's activities had finally ... found expression in popular culture through a new accessory for the Barbie Doll."

—*C&EN*, September 1, 1997

—Herb Hillman, Humbug's Nest, P.O. Box 135, Whitingham, VT 05361.

Journal of Coatings Technology

Reader Service Card
February 1994 Issue

Circle the numbers of the items you would like more information on, and mail it—postage paid!

001	021	041	061	081	101	121	141	161	181	201	221	241	261	281
002	022	042	062	082	102	122	142	162	182	202	222	242	262	282
003	023	043	063	083	103	123	143	163	183	203	223	243	263	283
004	024	044	064	084	104	124	144	164	184	204	224	244	264	284
005	025	045	065	085	105	125	145	165	185	205	225	245	265	285
006	026	046	066	086	106	126	146	166	186	206	226	246	266	286
007	027	047	067	087	107	127	147	167	187	207	227	247	267	287
008	028	048	068	088	108	128	148	168	188	208	228	248	268	288
009	029	049	069	089	109	129	149	169	189	209	229	249	269	289
010	030	050	070	090	110	130	150	170	190	210	230	250	270	290
011	031	051	071	091	111	131	151	171	191	211	231	251	271	291
012	032	052	072	092	112	132	152	172	192	212	232	252	272	292
013	033	053	073	093	113	133	153	173	193	213	233	253	273	293
014	034	054	074	094	114	134	154	174	194	214	234	254	274	294
015	035	055	075	095	115	135	155	175	195	215	235	255	275	295
016	036	056	076	096	116	136	156	176	196	216	236	256	276	296
017	037	057	077	097	117	137	157	177	197	217	237	257	277	297
018	038	058	078	098	118	138	158	178	198	218	238	258	278	298
019	039	059	079	099	119	139	159	179	199	219	239	259	279	299
020	040	060	080	100	120	140	160	180	200	220	240	260	280	300

Name _____

Company _____

Address _____

City _____ State___ Zip _____

Phone _____ FAX _____

Your Company
(Check One Block)

- AA ❑ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants, Adhesives
- BB ❑ Manufacturers of Raw Materials
- CC ❑ Manufacturers of Equipment and Containers
- DD ❑ Sales Agents for Raw Materials and Equipment
- EE ❑ Government Agency
- FF ❑ Research/Testing/Consulting
- GG ❑ Educational Institution/ Library
- HH ❑ Paint Consumer
- JJ ❑ Other

Your Position
(Check One Block)

- KK ❑ Management/Adm.
- LL ❑ Mfg. & Engineering
- MM ❑ Quality Control
- NN ❑ Research & Development
- PP ❑ Technical Sales Service
- QQ ❑ Sales & Marketing
- RR ❑ Consultant
- SS ❑ Educator/Student/Librarian
- TT ❑ Other

Journal of Coatings Technology

Reader Service Card
February 1994 Issue

Circle the numbers of the items you would like more information on, and mail it—postage paid!

001	021	041	061	081	101	121	141	161	181	201	221	241	261	281
002	022	042	062	082	102	122	142	162	182	202	222	242	262	282
003	023	043	063	083	103	123	143	163	183	203	223	243	263	283
004	024	044	064	084	104	124	144	164	184	204	224	244	264	284
005	025	045	065	085	105	125	145	165	185	205	225	245	265	285
006	026	046	066	086	106	126	146	166	186	206	226	246	266	286
007	027	047	067	087	107	127	147	167	187	207	227	247	267	287
008	028	048	068	088	108	128	148	168	188	208	228	248	268	288
009	029	049	069	089	109	129	149	169	189	209	229	249	269	289
010	030	050	070	090	110	130	150	170	190	210	230	250	270	290
011	031	051	071	091	111	131	151	171	191	211	231	251	271	291
012	032	052	072	092	112	132	152	172	192	212	232	252	272	292
013	033	053	073	093	113	133	153	173	193	213	233	253	273	293
014	034	054	074	094	114	134	154	174	194	214	234	254	274	294
015	035	055	075	095	115	135	155	175	195	215	235	255	275	295
016	036	056	076	096	116	136	156	176	196	216	236	256	276	296
017	037	057	077	097	117	137	157	177	197	217	237	257	277	297
018	038	058	078	098	118	138	158	178	198	218	238	258	278	298
019	039	059	079	099	119	139	159	179	199	219	239	259	279	299
020	040	060	080	100	120	140	160	180	200	220	240	260	280	300

Name _____

Company _____

Address _____

City _____ State___ Zip _____

Phone _____ FAX _____

Your Company
(Check One Block)

- AA ❑ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants, Adhesives
- BB ❑ Manufacturers of Raw Materials
- CC ❑ Manufacturers of Equipment and Containers
- DD ❑ Sales Agents for Raw Materials and Equipment
- EE ❑ Government Agency
- FF ❑ Research/Testing/Consulting
- GG ❑ Educational Institution/ Library
- HH ❑ Paint Consumer
- JJ ❑ Other

Your Position
(Check One Block)

- KK ❑ Management/Adm.
- LL ❑ Mfg. & Engineering
- MM ❑ Quality Control
- NN ❑ Research & Development
- PP ❑ Technical Sales Service
- QQ ❑ Sales & Marketing
- RR ❑ Consultant
- SS ❑ Educator/Student/Librarian
- TT ❑ Other

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12522 CHICAGO, ILLINOIS

POSTAGE WILL BE PAID BY ADDRESSEE

Journal of Coatings Technology
Reader Service Center
650 S. Clark St.
Chicago, IL 60605-9960

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12522 CHICAGO, ILLINOIS

POSTAGE WILL BE PAID BY ADDRESSEE

Journal of Coatings Technology
Reader Service Center
650 S. Clark St.
Chicago, IL 60605-9960

Crosslinked cures for the common coating

So, you've got a coating that's under the weather. Or need a cure for low temperatures. You want a stronger grip on metal, plastic, wood, glass, rubber, or concrete substrates. Or abrasion resistance has got you down. If so, we've got the new cure technologies for the broadest formulation latitude.

Our low-VOC two-part epoxy/amine, peroxide and UV/EB cure technologies allow you to enhance coatings for a wide range of substrates and conditions.

Explore our world of problem-solving crosslinkable products and additives—from acrylic monomers and oligomers to hydrocarbon resins and UV photoinitiators. For instance, have you considered thermal cure crosslinked coatings? Or low-temperature, two-part epoxy/amine cures? Or fast peroxide cures? Or instant UV/EB cures?

You can use our products in these new low-VOC technologies to cure coating problems where water-borne and solvent-based systems fail. So, call for technical information or assistance.

Sartomer and Cray Valley (our European-based sister company) can support you worldwide.

Yours FREE
"New Technologies That Reduce VOCs"

Call 1-800-SARTOMER
502 Thomas Jones Way
Exton, PA 19341
http://www.sartomer.com

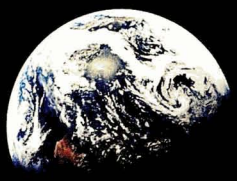
SARTOMER
Our name means tailor-made

Responsible Care:®
A Public Commitment
Sartomer Co., Inc. - Member, Chemical Manufacturers Association

Responsible Care and hands logo are registered trademarks of the Chemical Manufacturers Association

©1997 Sartomer Company, Inc., a member of Total group

Circle No. 181 on the Reader Service Card



Use Less

Create New Applications

Cut Costs

Maybe we've gone too far with our new Irgacure® 819 photoinitiator

Irgacure 819 from Ciba Additives can be used in UV curable formulations for clear as well as pigmented coatings on wood, metal, plastic, paper, optical fibers, printing inks and prepregs.

It gives outstanding curing performance in highly pigmented systems even at low concentrations. Some of our customers improved solubility and eliminated yellowing when they used Irgacure 819 at a 50% reduced concentration over standard photoinitiator loading levels.

Irgacure 819 provides exceptional performance in thick color coatings as well as in bright whites. This versatile new product allows you to do things in UV coatings you've never been able to do before. What's more, some say that because of Irgacure 819, the time of the expensive photoinitiator is over.

Call us for detailed information and see for yourself how you can use less and get more.

For more information
call us at 1-800-881-8449

Ciba Specialty Chemicals
USA

Additives
Imaging and Coating Additives
www.cibasc.com

Responsible Care ISO 9001

Ciba

Value beyond chemistry

Circle No. 196 on the Reader Service Card

2 6 JUN 2541