

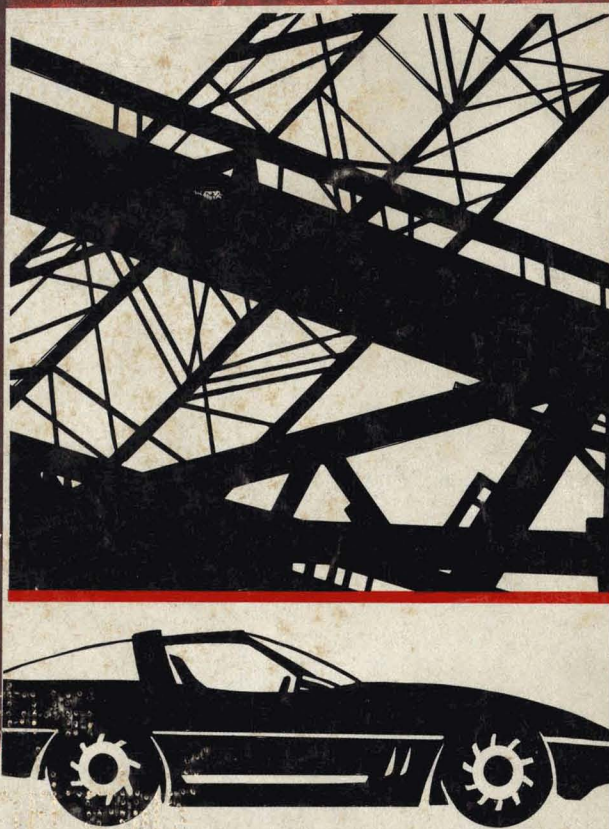
JOURNAL OF COATINGS TECHNOLOGY

JCTAX 56 (714) 1-76 (1984)

July 1984



**Special
Feature
Issue:
CORROSION**





NEWLY DISCOVERED RHEOLOGICAL PROPERTIES FOR SALE.

Once you set foot in the bright, new world of UCAR Associative Thickeners you'll never look back.

Because our new UCAR Thickeners SCT-100 and SCT-200 are nonionic, water-soluble synthetic polymers designed to give your architectural, industrial and maintenance latex paints superior performance.

Improved flow and leveling, higher gloss and better hiding are just some of the benefits that come with the territory.

Compared to the thickeners you're probably using now, you'll appreciate the significant advantages of UCAR Thickeners SCT-100 and SCT-200 in terms of higher film build and superior spatter resistance.

You'll also be pleased to know that UCAR Thickener SCT-100 provides the maximum flow in both high solids and cellulosic thickened formulations and that UCAR Thickener SCT-200 imparts such good sag resistance that it may be the only thickener you'll need.

To discover more about our new UCAR Thickeners, contact your local Union Carbide Sales Representative. Or write to us at Department K3444, Danbury, CT 06817.

We think you'll find all the rheological properties you need to gain ground in the paint business.



Coatings Materials

A million tiny creatures just sent your latex paint to a watery grave.

Now you can protect your vinyl-acrylic and 100% acrylic latex paints from cellulase enzymes that thin your product.

Natrosol® B, the universal thickener for all types of latex paint, outperforms all the rest in three critical areas:

Superior retention of initial viscosity; superior resistance to enzyme attack; and superior color acceptance.

For more about how Natrosol B hydroxyethylcellulose can help you produce a better latex paint with superior resistance to enzyme attack, contact Hercules Incorporated, Hercules Plaza, Wilmington, DE 19894, Attn: D. Joyce. Or call (302) 594-6500, Ext. 7461.



Natrosol B
The enzyme-resisting thickener.
From Hercules, of course.





Special Feature Issue: Corrosion

- Technical Articles**
- 31 Characterization of the Variability in Corrosion Resistance of Steel Using Electrochemical Techniques—R.G. Groseclose, C.M. Frey, and F.L. Floyd
- 43 Resin Structure and the Corrosion Resistance of Organic Coatings: Epoxy-Alkanolamine Resins—J.W. Holubka and R.A. Dickie
- 49 Effect of Zinc Oxidation on the Conductivity and Performance of Di-Iron Phosphide Augmented Zinc-Rich Primers—N.C. Fawcett, C.E. Stearns, and B.G. Bufkin
- 55 Ellipsometric Studies of Chelating Inhibitor Effects on the Cathodic Delamination of an Organic Coating on Iron—J.J. Riffer
- Federation News**
- 17 Initial FSCT 'Spring Week' Glowing Success in Louisville
- 20 Two Speakers to 'Kick-Off' 1984 Annual Meeting At Opening Session
- 25 1984 Annual Meeting Advance Registration and Housing Forms
- Departments**
- Comment** 7 **Society Officers**
- Abstracts** 10
- Committee Activities** 12 **OSHA Hazard Communication Standard—A Review**
- Government and Industry** 22 **Coated Coil Rebounds in '83; Prognosis Good for '84**
- Society Meetings** 63
- Elections** 65
- Meetings/Education** 67 **Five FSCT Members to Present Papers at XVIIth FATIPEC Congress**
- People** 69
- Obituary** 70
- Book Review** 71 **'Aluminum and Bronze Flake Powders' and 'Surface Coatings, Volume I'**
- Literature** 72
- Coming Events** 74
- Humbug from Hillman** 76 **Drying Time According to Johnny Bench**

ห้องสมุดกรมวิทยาศาสตร์บริการ

พ.ค. 2527



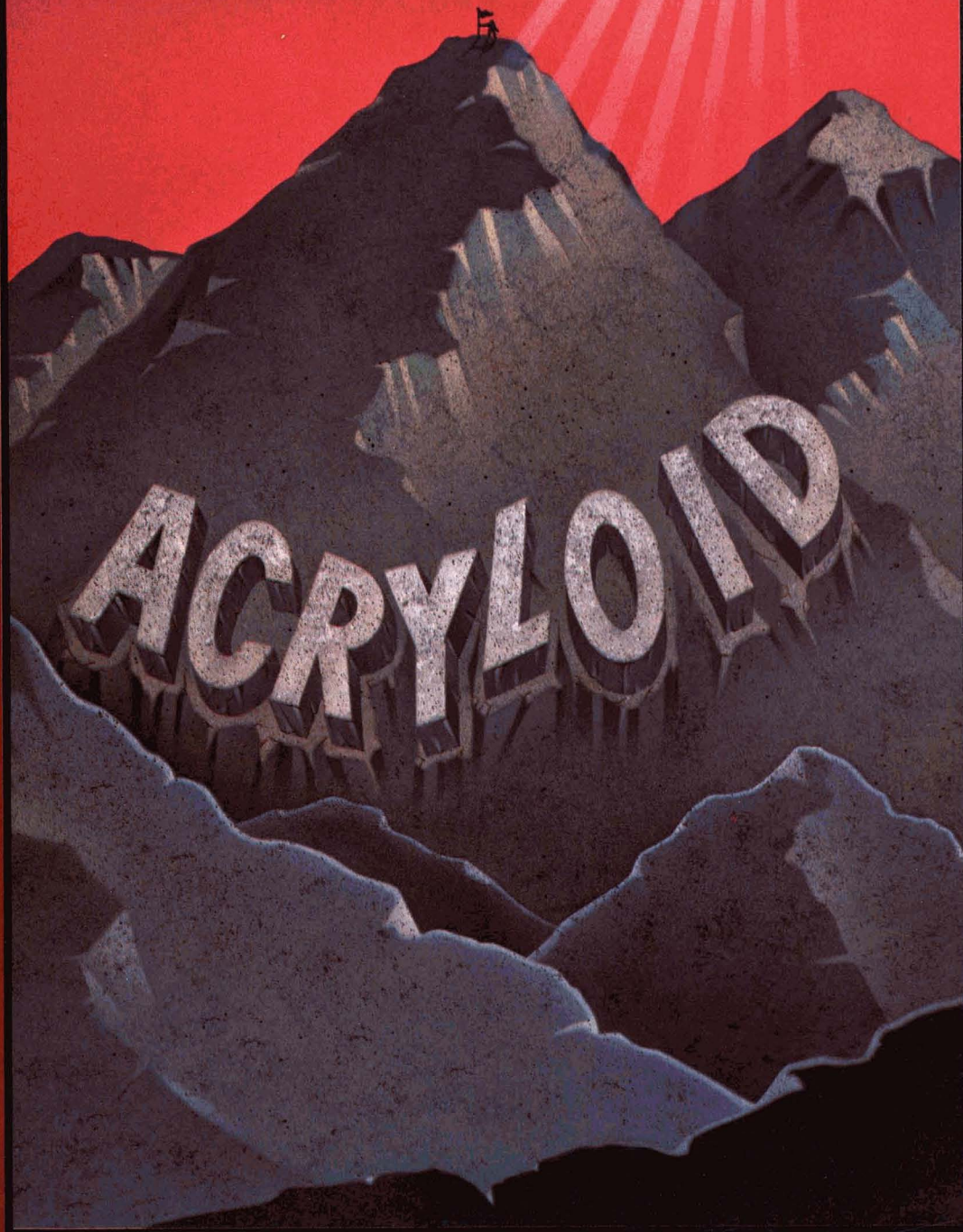
© 1984 by FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

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

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

Subscriptions: U.S. and Canada—1 year, \$27; 2 years, \$51; 3 years, \$73. Europe (Air Mail)—1 year, \$50; 2 years, \$97; 3 years, \$142. Other countries—1 year, \$37; 2 years, \$71; 3 years, \$103.

New ideas for industrial baking finishes.



ACRYLOID is a registered trademark of ROHM AND HAAS COMPANY.

Conquer your high-solids problems.

Move up to

ACRYLOID[®] high-solids thermosetting acrylic resins for low-VOC and peak performance.

Get a foothold on exciting technology advances.

Does your high-solids coating have problems with sagging, cratering, tacky overspray, pigment dispersion, metal rinse-mark telegraphing, outdoor durability? Replacing part or all of your vehicle with an ACRYLOID high-solids thermosetting acrylic resin could solve your problem and put you on the track to added benefits from the latest technology.

Get to the top with ACRYLOID high-solids acrylics.

Using a vehicle from our family of ACRYLOID high-solids acrylics could give your coating these properties:

- Less than 3.0 VOC capability.
- Exterior durability.
- Excellent application properties.
- Sag resistance.
- Cratering resistance.
- Resistance to rinse-mark telegraphing.
- Easy-to-remove overspray.
- Stain, chemical, and solvent resistance.

The durability and quality performance of ACRYLOID high-solids thermosetting polymers have been proved by years of exposure testing and commercial use. Our new Resin QR-954 offers sub-3.0 VOC capability and an excellent balance of performance properties.

Our acrylics are excellent for coating aluminum extrusions, metal furniture (office, home, lawn, etc.), and appliances—and for general metal finishing. Blend them with the polyester you're using, to upgrade performance . . . or use them as sole vehicles.

If you contact us, we'll gladly help you pick the vehicle that will suit your application best.

Stay on top with Rohm and Haas research and service.

In the very near future, you'll be formulating with even higher performance "second-generation" resins, based on new chemistry, which Rohm and Haas research has developed and is now evaluating.

Along with ACRYLOID high-solids vehicles come the benefits of working with the leader in high-solids acrylics:

- New concepts evolving from creative research and development.
- The most advanced technology. Superior knowledge, background, and experience.
- Proven track record in commercial applications.
- Excellent technical service. Large, well-trained field force.
- Multiple plants—for reliable supply.
- Producer who is basic in raw materials for acrylics.

Get help in selecting a high-solids vehicle, plus product literature and evaluation samples by calling your Rohm and Haas technical representative or contacting our Marketing Services Dept., Independence Mall West, Philadelphia, PA 19105.

Ask us. We've got the answers.

**ROHM
AND
HAAS** 
PHILADELPHIA, PA. 19105

Journal of Coatings Technology

1315 Walnut St., Phila., Pa. 19107

THE JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology at 1315 Walnut St., Philadelphia, Pa. 19107. Phone: (215) 545-1506.

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

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	\$27.00	\$ 50.00	\$ 37.00
2 Years	\$51.00	\$ 97.00	\$ 71.00
3 Years	\$73.00	\$142.00	\$103.00

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

Staff

FRANK J. BORRELLE PUBLISHER
 ROBERT F. ZIEGLER EDITOR
 THOMAS J. MIRANDA TECHNICAL EDITOR
 THOMAS A. KOCIS CONTRIBUTING EDITOR
 PATRICIA D. VIOLA ASSOCIATE EDITOR
 LORRAINE LEDFORD ADVERTISING SERVICES MANAGER
 MARIE EICHLER PUBLICATIONS ASSISTANT

Publications Committee

THOMAS J. MIRANDA, Chairman
 PAUL R. GUEVIN, JR., Vice-Chairman

FRANK J. BORRELLE THOMAS A. KOCIS
 DARLENE BREZINSKI SIDNEY LAUREN
 LOREN W. HILL PERCY E. PIERCE

ROBERT F. ZIEGLER

Editorial Review Board

THOMAS J. MIRANDA, Chairman

T. ANAGNOSTOU	G.D. EDWARDS	S. LAUREN
H.E. ASHTON	F.L. FLOYD	H. LOWREY
G.P. BIERWAGEN	P.R. GUEVIN, JR.	M.J. McDOWELL
D. BREZINSKI	H.E. HILL	P.E. PIERCE
G.D. CHEEVER	L.W. HILL	P.R. SPERRY
R.A. DICKIE	J.V. KOLESKA	R. STANZIOLA
R. DOWBENKO		J.A. VASTA

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

A Guide for Authors is published in each January issue. The JOURNAL OF COATINGS TECHNOLOGY is available on microfilm from University Microfilms, a Xerox Co., Ann Arbor, Mich. 48106.

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

Copyright 1984 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.



FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY BOARD OF DIRECTORS 1983-1984

PRESIDENT

*TERRYLL F. JOHNSON
 Cook Paint & Varnish Co.
 P.O. Box 389
 Kansas City, MO 64141

JAMES A. HOECK
 Reliance Universal, Inc.
 Louisville, KY

NORMAN A. HON
 Cook Paint & Varnish Co.
 Kansas City, MO

PRESIDENT-ELECT

*JOSEPH A. BAUER
 Porter Paint Co.
 400 S. 13th St.
 Louisville, KY 40203

BERGER JUSTEN
 Justen & Associates
 Tampa, FL

DAVID LOVEGROVE
 Carrs Paints Ltd.
 Birmingham, England

TREASURER

*WILLIAM MIRICK
 Battelle Memorial Institute
 505 King Ave.
 Columbus, OH 43201

HARRY B. MAJCHER
 Standard Detroit Paint Co.
 Detroit, MI

BARRY ADLER
 Royale, Inc.
 Menlo Park, CA

GARY MARSHALL
 Paint Products Co., Inc.
 Walkertown, NC

RUDOLPH C. ALBRECHT
 Ace Paint Div.,
 Ace Hardware Corp.
 Matteson, IL

JAMES A. MCCORMICK
 Inland-Leidy
 Baltimore, MD

*A. CLARKE BOYCE
 Nacan Products Ltd.
 Toronto, Ont., Canada

*DERYK R. PAWSEY
 Rohm and Haas Can. Inc.
 Vancouver, B.C., Canada

WILLY C.P. BUSCH
 PPG Industries, Inc.
 Houston, TX

JAMES E. PETERSON
 Peterson Paints
 Pueblo, CO

MORRIS COFFINO
 D.H. Litter Co., Inc.
 New York, NY

*HORACE S. PHILIPP
 Sherwin-Williams Co.
 Montreal, Que., Canada

DERMONT G. CROMWELL
 Sinclair Paint Co.
 Los Angeles, CA

ANTONIO PINA
 Mexicana de Pinturas Intl.
 Ixtapalapa, Mexico

CARLOS E. DORRIS
 Jones-Blair Co.
 Dallas, TX

LLOYD REINDL
 Englewood, OH

WILLIAM DUNN
 Downsview, Ont., Canada

*FRED G. SCHWAB
 Coatings Research Group, Inc.
 Cleveland, OH

NEIL S. ESTRADA
 Los Altos Hills, CA

SAUL SPINDEL
 D/L Laboratories, Inc.
 New York, NY

TED FAVATA
 Triangle Coatings Co.
 Berkeley, CA

DANIEL TOOMBS
 Lukens Chemical Co.
 Westboro, MA

TOM FITZGERALD, SR.
 Sterling Lacquer Mfg. Co.
 St. Louis, MO

*JOHN T. VANDEBERG
 DeSoto, Inc.
 Des Plaines, IL

RICHARD L. FRICKER
 Valpar Corp.
 Minneapolis, MN

EDWARD VANDEVORT
 PPG Industries, Inc.
 Springdale, PA

CARL W. FULLER
 Reichard-Coulston, Inc.
 Bethlehem, PA

KURT WEITZ
 Indusmin Ltd.
 Toronto, Ont., Canada

AL HEITKAMP
 Cargill, Inc.
 Minneapolis, MN

*Executive Committee Members

THOMAS HILL
 Pratt & Lambert, Inc.
 Buffalo, NY

EXECUTIVE VICE-PRESIDENT

FRANK J. BORRELLE
 FSCT Headquarters Office
 1315 Walnut St.
 Philadelphia, PA 19107

Society Officers

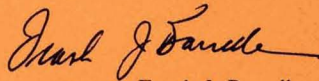
One of the major events during the Federation's annual "Spring Week" is the orientation meeting between Federation Officers/Staff and officers from the Federation's 26 Constituent Societies.

The eighth such meeting was held in Louisville this year and present were either the Secretary or the Treasurer from the Societies. Interest was high and discussions enlightening during the all-day review and critique of Federation/Society activities, organization, administration, and yes—problem areas.

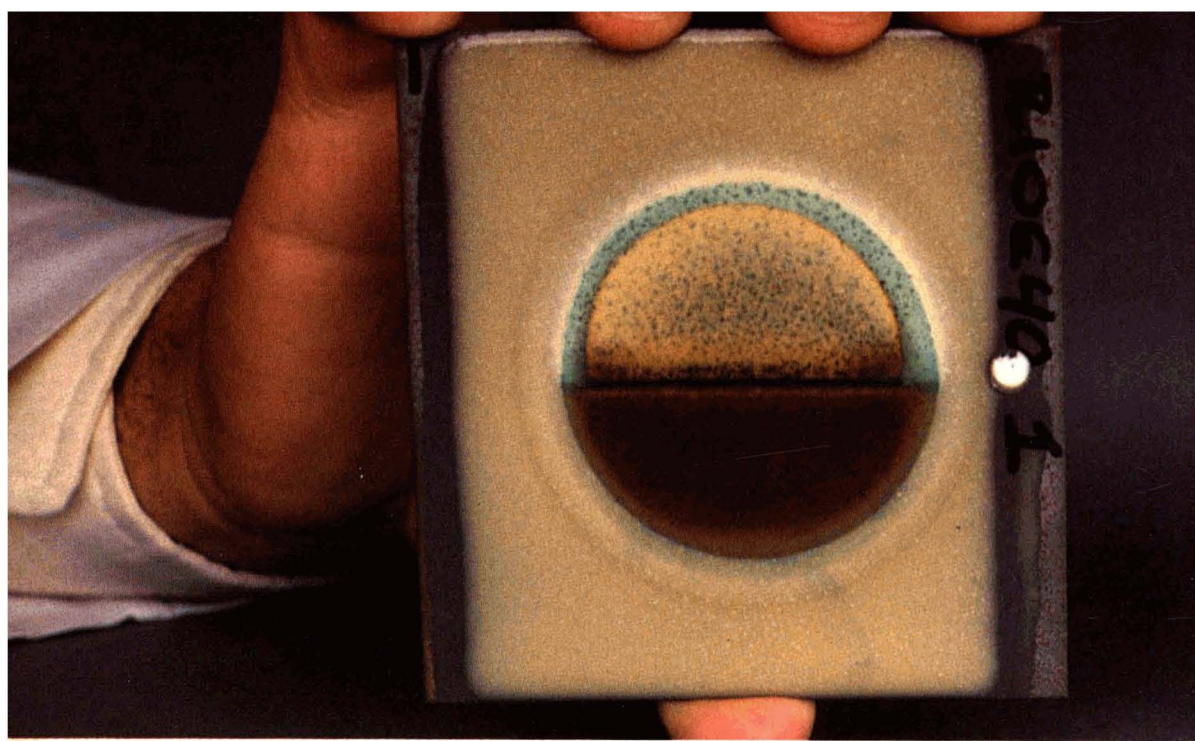
The Federation is pleased to sponsor this meeting and the impressive near-100% attendance each year is a good indication that the across-the-table dialogue is worthwhile and will go on for a long time.

But what impresses us most is the continuing high caliber of ladies and gentlemen who go through the Chairs of their Societies. These fine folks take their volunteer work very seriously.

With such dedication, spirit, and enthusiasm, both the Federation and the Societies have no place to go but onward and upward.



Frank J. Borrelle,
Executive Vice-President



CIBA-GEIGY epoxy hardeners vs. the toughest applications around.

You can now formulate practical, durable coatings for such difficult applications as pollution control equipment.

Conditions are so hostile inside a coal-burning utility's flue gas desulfurization unit that, until today, no completely satisfactory coating has existed. Traditional coatings for carbon steel have been too



Encapsulated in our XU 252 and XU 264 system, this strip of steel was immersed in a 50% sulfuric acid bath for two hours at room temperature then, without rinsing, put into a 350° oven for 30 minutes. This was followed by quenching in sulfuric acid. After 10 such cycles, there was slight surface charring— but no penetration.

brittle. And exotic alloys have been too costly.

Now, however, there is an answer. An answer that, for the first time, allows you to formulate an organic coating with the characteristics you need to meet the demands of this particularly difficult application.





In 14 days of continuous exposure in an Atlas Cell, refluxing 50% sulfuric acid had virtually no effect on the combination of our XU 252 epoxy resin and XU 264 epoxy hardener. After only four days, however, a conventional system was completely destroyed.

Start with a high performance resin.

Our system begins with XU 252, a high performance epoxy resin that has already proven its worth against chlorinated solvents, ethanol, methanol, aromatic amines, acids, caustic and ammonia—and proved it under a wide range of service temperatures.

But you require more than a high performance resin to formulate a superior coating. You also need a high technology hardener that can produce the desired physical qualities in the cured system.

Combine with a high technology hardener.

Today, CIBA-GEIGY offers two highly versatile hardeners that you can combine with XU 252 to formulate coating systems with the high level of resistance and durability you require.

The first, XU 264, is a toughened aromatic amine-based epoxy hardener that is particularly suitable for high temperature service. It provides good flexibility, superior toughness, and excellent resistance to sulfuric acid—properties that make it the ideal hardener for use in high performance coatings for the scrubbers, ducts and stacks in flue gas desulfurization units.

The second of these new products, XU 265, is a liquid hardener that cures epoxy resins into coatings that are highly resistant to acid, alkali,

solvents and chemicals. In combination with XU 252, it produces a coating system that is widely used, for example, in tanks, processing plants and transmission pipes.

Add in responsive service.

So when you are faced with the toughest applications, and need to formulate the toughest coating systems, we believe the choice of a supplier is clear. The CIBA-GEIGY Resins Department—the one source that combines high technology specialty resins and hardeners. We are ready to help with your toughest problems at Three Skyline Drive, Hawthorne, New York 10532. Call 800 431-1900. In New York, 914 347-4700.



CIBA-GEIGY

Abstracts of Papers in This Issue

CHARACTERIZATION OF THE VARIABILITY IN CORROSION RESISTANCE OF STEEL USING ELECTROCHEMICAL TECHNIQUES—R.G. Groseclose, C.M. Frey, and F.L. Floyd

Journal of Coatings Technology, 56, No. 714, 31 (July 1984)

In testing paints for corrosion resistance, coating companies have had to cope with the variability of the metal test substrate. Previous methods in the literature to quantify steel quality and variability are time consuming and expensive. A novel and quick electrochemical technique has been developed using anodic polarization of metal test specimens in a mildly corrosive electrolyte. This has led to an electrochemical profile of the uncoated steel that can predict the relative salt spray performance of the coated panel. The variability of hot rolled steel has also been quantified. Additional characterization was carried out on abrasively polished and sandblasted steel. Such mechanical cleaning was shown to dramatically reduce the variability of the steel.

RESIN STRUCTURE AND THE CORROSION RESISTANCE OF ORGANIC COATINGS: EPOXY-ALKANOLAMINE RESINS—J.W. Holubka and R.A. Dickie

Journal of Coatings Technology, 56, No. 714, 43 (July 1984)

Coatings with exceptional resistance to corrosion induced adhesion loss have been obtained from formulations based on epoxy alkanolamine resins and aminoplast crosslinkers. Spray primers with excellent corrosion resistance have been formulated from epoxy alkanolamine resins without the use of inhibitive pigments. The epoxy alkanolamine resins are reaction products of alkanolamines with Bisphenol A-epichlorohydrin epoxy resins; the aminoplast crosslinkers are conventional melamine-formaldehyde and urea-formaldehyde condensation products. Effects of resin structure on coating performance in accelerated corrosion and humidity testing, and on shelf life of formulated primers, are examined in detail. Best results are obtained with epoxy alkanolamine resins prepared from high molecular weight Bisphenol A-epichlorohydrin epoxy resins and a chemically equivalent amount (based on epoxide functionality) of secondary alkanolamine. Control experiments suggest that the excellent corrosion resistance of coatings formulated with epoxy-alkanolamine resins results from the

resistance of the polymer to degradation by corrosion generated hydroxide, rather than from differences in transport properties or from the presence of amine or other specific functionality in the resin.

EFFECT OF ZINC OXIDATION ON THE CONDUCTIVITY AND PERFORMANCE OF DI-IRON PHOSPHIDE AUGMENTED ZINC-RICH PRIMERS—N.C. Fawcett, C.E. Stearns, and B.G. Bufkin

Journal of Coatings Technology, 56, No. 714, 49 (July 1984)

Five pigment-grade zinc dusts are analyzed and found to vary in oxide content from 4 to 44%. Zinc dust that is initially low in oxide is artificially aged to create a range of dusts with increasing oxide content. These dusts are used to explore the effect of zinc oxidation on the anti-corrosion performance of a primer co-pigmented with zinc and di-iron phosphide. It was found that for a primer pigmented with an equal weight of zinc and di-iron phosphide the optimum ZnO content of the zinc portion of the pigment lies between 18 and 27%. Primer performance in salt fog and humidity testing, and primer conductivity are reported as functions of degree of zinc oxidation. The results are found to be consistent with the previously proposed mechanism for di-iron phosphide function in zinc primers.

ELLIPSOMETRIC STUDIES OF CHELATING INHIBITOR EFFECTS ON THE CATHODIC DELAMINATION OF AN ORGANIC COATING ON IRON—J.J. Ritter

Journal of Coatings Technology, 56, No. 714, 55 (July 1984)

Qualitative ellipsometry has been used to study the effects of chelating inhibitors on the cathodic delamination of an acrylic coating from an iron surface. The chelating inhibitors 8-hydroxyquinoline (8-HQ) and 2,5 dimercapto 1,3,4 thiadiazole (DMTDA), when dispersed in the coating were observed to delay the onset of delamination. A similar beneficial effect was noted with a two-layer system employing a zinc chromate primer. Catechol was found to be an ineffective inhibitor. Moreover, when 8-HQ and DMTDA were applied by an anodic pretreatment procedure they were relatively ineffective, whereas 4-methylcatechol similarly applied exhibited impressive inhibition.

Fit 'n Finish

Resimene® meets your critical criteria shipment after shipment.

Today, every automobile that rolls off the production line must meet rigid specifications in both component fit and finish. As a result, coatings formulators must demand consistently high quality and readily available ingredients—like Resimene aminoplast cross-linkers by Monsanto.

Our state-of-the-art Fisher PR6VOX® batch controller—the first of its kind in the industry—



maximizes the batch-to-batch consistency of Resimene. This new advanced computer system “closes the loop” by continually monitoring and adjusting the production process for Resimene.

In addition, we're increasing our production capabilities for Resimene through a second facility, centrally located in Cincinnati. As a result, you can depend on increased availability and timely delivery of Resimene.

For more information about Resimene and how computer batch control can help you meet your customers' consistency requirements, write Monsanto Polymer Products Company, Department 804, 800 N. Lindbergh Blvd., St. Louis, MO 63167.

**Resimene.
For the finest finishing touch,
batch after batch.**

Monsanto

Resimene® is a registered trademark of Monsanto Company.
PR6VOX® is a registered trademark of Fisher Controls International, Inc.
© Monsanto Company, 1984 MPP-4-311R

Committee Activities

Environmental Control Committee

OSHA Hazard Communication Standard—A Review

The U. S. Occupational Safety and Health Administration (OSHA) published their Hazard Communication Standard—Final Rule in the *Federal Register* of November 25, 1983.

This is a comprehensive standard covering employers and employees in the manufacturing sector, at this time. It covers the Standard Identification Classifications (SIC) Codes 20-39. Paint manufacturing is SIC Code 28.

It is a general performance standard in the sense that OSHA carefully explains their objectives and requirements and allows those affected to develop their own wording and programs to meet the objectives.

From the standpoint of the paint manufacturer, all production is covered, whether it be trade sales or industrial coatings manufacture. The emphasis is on the raw materials—their storage, use, and levels of hazard.

Finished products are handled in different ways. Industrial coatings are a raw material to the downstream customer and certain minimum labeling is specified for these containers. MSDS sheets must be furnished.

Trade sales finished products, however, are exempt from these requirements.

Definitions

The Final Standard includes a number of definitions which provide the framework to determine which employers are covered by the Standard, what substances are covered, how the Standard defines hazards and how OSHA defines other specific terms for purposes of the Standard.

The Standard applies to both "physical" and "health" hazards. Each of these terms is defined by listing the various types of physical and health hazards covered. These listed hazards are then individually defined, or in the case of health hazards, further explained in an appendix.

Hazard Determination

The Standard designates as hazardous per se, chemicals currently regulated by OSHA and those listed in the *ACGIH TLV LIST*. In addition, OSHA has defined a carcinogen for purposes of hazard communication as any substance found to be a confirmed or suspected carcinogen by IARC, NTP, or OSHA.

Mixtures are divided into several considerations. First of all, if the employer has objective test data on the mixture as a whole, that data must be used to determine the hazards. If such data are not available for the health hazard determination, then the employer must consider the mixture to have the health hazards of those components which comprise 1% or more of the total composition. If any of the components are carcinogens, the mixture must be considered to be carcinogenic if the component is present in concentrations of 0.1% or more.

Material Safety Data Sheets

Hazardous ingredients are to be listed down to 1%; carcinogens to 0.1%. Employers must also list ingredients present in concentrations of less than these percentages if there is evidence that the permissible exposure limit may be exceeded or if it could present a health hazard in these concentrations.

Where the hazards are the same for similar mixtures, employers may prepare one MSDS for all of these similar mixtures.

The MSDS should be provided with the first shipment; if updated, the new version must be transmitted in the next shipment.

Written Hazard Communication Program

Every employer must have a written program which includes: how the employer plans to meet the provisions of the Standard regarding labels, MSDSs and training; a list of the hazardous chemicals in the work area; the methods the employer will use to inform employees of non-routine tasks, as well as hazards associated with chemicals contained in unlabeled pipes in their work areas; and the methods employers will use to inform contractors in their manufacturing facilities of the hazards their employees may be exposed to.

Labels

Each container in the workplace must be labeled, tagged, or marked with the identity of the hazardous chemicals contained therein, and hazard warnings

appropriate for employee protection. For stationary containers, employers may use standard operating procedures, process sheets, batch tickets, blend tickets, or other similar means as a substitute for individual labels.

Employee Information and Training

Employers are to establish a training and information program for employees exposed to hazardous chemicals. Employees are to be informed of the requirement of the Final Standard and the components of the hazard communication program in their workplace.

Employees are also to be informed of any operations in their work area where hazardous chemicals are present, and where the employer will be keeping the written material required by the Standard.

Employees are to be trained regarding methods and observations they may use to detect the presence of a hazardous chemical in their work area. The employer is to thoroughly explain the hazard communication program implemented in that workplace and how to use the hazard information provided.

The Hazardous Materials Identification System (HMIS) developed by the National Paint and Coatings Association is an excellent system for complying with the requirements of the OSHA Standard.

Trade Secrets

OSHA recognizes in the Final Standard that specific chemical identity information can constitute a *bona fide* trade secret, and thus provisions are made to protect such an identity while providing for the proper protection of exposed employees. This is accomplished by providing for limited trade secret disclosure to health professionals under prescribed conditions of need and confidentiality.

Effective Dates

November 25, 1983—Final Rule published.

November 25, 1985—Labeling and MSDS programs in place.

May 25, 1986—Full compliance with all other provisions, including employee training.



A more active flow at a less active price.

Presenting Modaflow® Powder III resin modifier...the improved acrylic flow aid by Monsanto that costs less than Modaflow Powder II, yet offers *more* active ingredient.

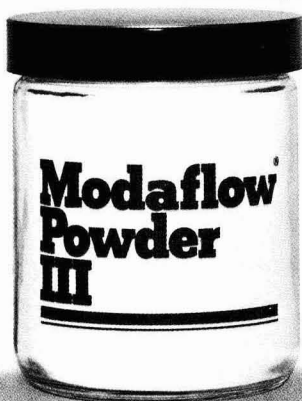
Modaflow Powder III has 5% more active ingredient than Modaflow Powder II: 65% as compared to the previous 60%. So you can use 8% less material than Modaflow Powder II in your formulations.

In addition, Modaflow Powder III is based on a more efficient processing technique. As a result, we're able to produce and sell Modaflow Powder III for less per pound than its predecessor. And that adds up to savings for you.

Best of all, Modaflow Powder III is backed by one of the world's largest chemical companies—Monsanto—recognized by the coatings industry as the acrylic flow aid leader for over 25 years.

Now you can have a more active flow aid, for a less active price—with Modaflow Powder III. Call 1-800-325-4330, extension 3381, for the Modaflow Powder III price schedule, and a free sample.

Modaflow® is a trademark of Monsanto Company.
© Monsanto Company 1984 MPP-4-310

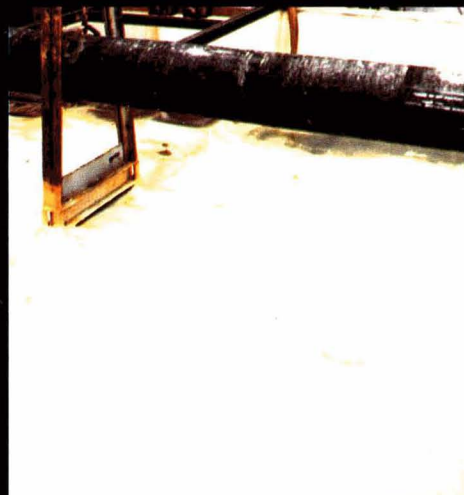
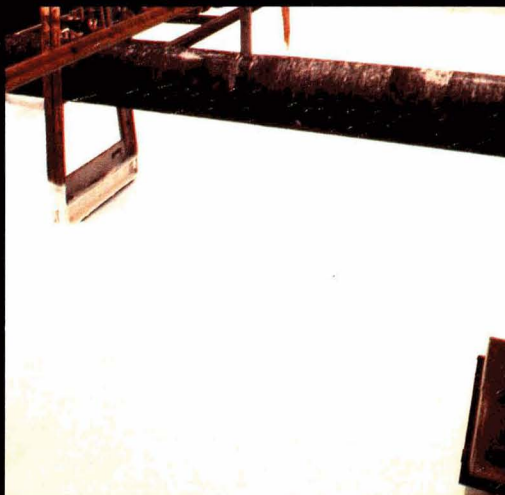


Monsanto

ACRYLIC BREAKTHROUGH

DO THE ROOFING

The reflective roof mastic based on RHOPLEX EC technology was spray applied on a roof in a heavy industrial environment in Pennsylvania. The photo at the lower right shows the same roof more than one year later.



INDUSTRY A BIG ACRYLIC FAVOR

Offer Roof Mastics Based on New RHOPLEX™ EC Technology

Introducing RHOPLEX® EC-1895 emulsion for superior resistance to water ponding conditions and RHOPLEX EC-1791 emulsion for superior adhesion to polyurethane foam. Acrylics from RHOPLEX EC technology are well known for:

- Long term durability
- Long lasting flexibility even at low temperatures
- Superior dirt pick-up resistance and reflectivity

RHOPLEX EC-1685 acrylic is the standard, when water ponding and adhesion are not problems.

For flat roofs with potential water ponding problems, the new RHOPLEX EC-1895 acrylic helps to keep bulk water from passing through the protective coating. Acrylics are known as breathers, not water vapor barriers. They transmit low levels of water vapor through the coating and thereby resist the formation of vapor traps in the building.

Another new roof mastic polymer, RHOPLEX EC-1791 provides elastomeric coatings with superior wet and dry adhesion to low and high density polyurethane foam.

Do your roofing contractors the favor of providing a seamless coating based on RHOPLEX EC technology. It goes on faster than sheets, eliminates hot tars, and reduces customer call backs. This saves time and money.

All you need to do to profit from this business opportunity is to combine your paint formulating know-how with RHOPLEX EC technology. Find out more about the product-line of acrylic polymers designed specifically for roof mastics. Write to Rohm and Haas Company, Marketing Services Department, Independence Mall West, Philadelphia, PA 19105.



This roof in Florida demonstrates how a roof mastic based on RHOPLEX EC-1895 acrylic retains its initial integrity under ponded water conditions.



The foam actually tore during peel adhesion testing on an Instron unit documenting adhesion of the mastic based on RHOPLEX EC-1791 acrylic.

"CREATIVE COLORSHIP FOR OVER A CENTURY"



COLORSHIP is TECHNOLOGY

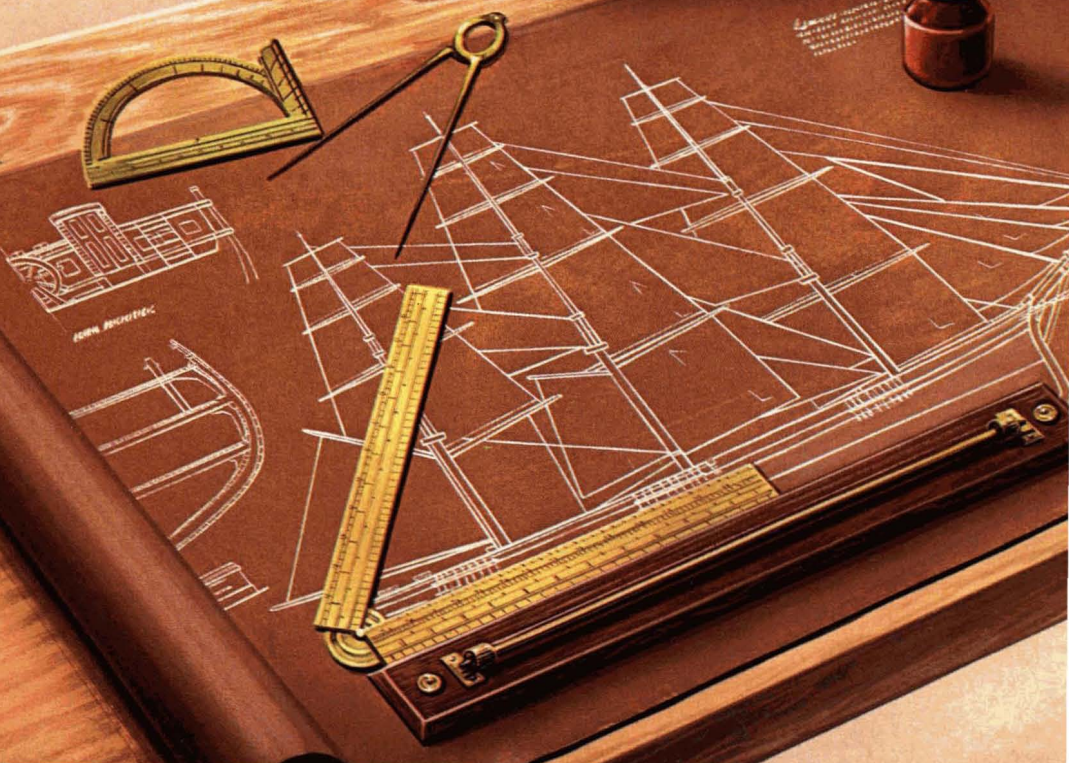
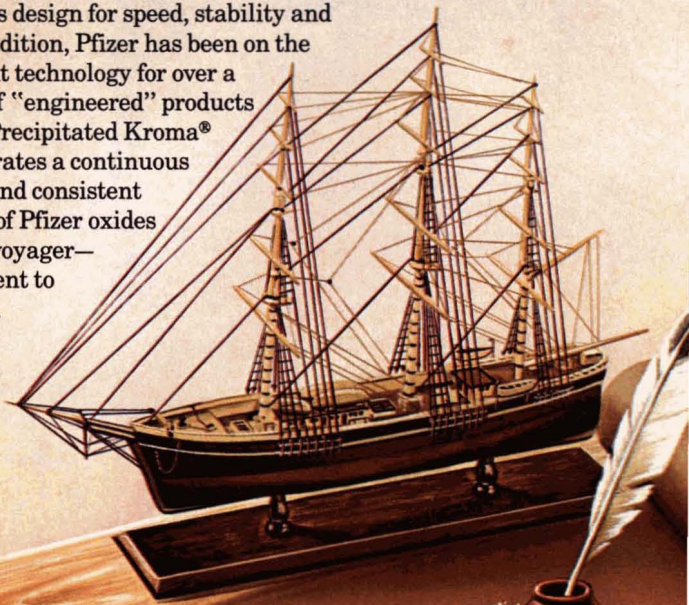
The Yankee Clippership represented American technological leadership as it roamed the world's oceans in the 19th century. Nothing could match its design for speed, stability and stature. In the same tradition, Pfizer has been on the leading edge of Pigment technology for over a century. Introduction of "engineered" products such as Pfferrisperse™ Iron Oxide Slurry, Precipitated Kroma® Reds, and Low Viscosity Yellows demonstrates a continuous commitment to technology. High purity and consistent quality have resulted in the specification of Pfizer oxides in the rocket motors of America's newest voyager—The Space Shuttle. Colorship is commitment to technology. At Pfizer, there's no other way.



MINERALS, PIGMENTS & METALS DIVISION

Dept. 3C-2

25 E. 42nd Street, New York, N. Y. 10017



REPORT FROM THE EXECUTIVE VICE-PRESIDENT

Initial FSCT 'Spring Week' Glowing Success in Louisville

The Federation's first "Spring Week" could not have made its debut at a better location and at a better time. The weather in Louisville was very pleasant and was exceeded only by the superb hospitality extended and arranged by the Louisville Society, local paint manufacturers and supplier firms, Louisville Convention Bureau, the Galt House, and the Commonwealth Convention Center. The red carpet was out everywhere.

There were three major events: (1) Seminar on "Producing Paint Efficiently, Safely, and Economically"; (2) Society Officers Meeting; and (3) Board of Directors Meeting. In between were receptions sponsored by our hosts.

Seminar

The Seminar on May 15-16 at the beautiful Convention Center was a great success. Attendance was 136, of which 113 were paid. From all reports, attendees were pleased with the subject matter, the speakers, and the arrangements.

Society Officers Meeting

This full-day orientation session on May 17 at the Galt House was attended by 26 Society Officers and three new Society Representatives to the Federation Board. It was the 8th annual meeting and, like all previous ones, was an enlightening and informative meeting for all who participated.

Board of Directors Meeting

Major business from this meeting on May 18 at the Galt House follow.

Attendance (54): Thirty-four members of Board and 20 guests (among them the President of NPCA and 15 Society Officers who stayed over from the previous day's meeting).

FSCT Financial Report: First quarter statement indicated that income and expenses are in keeping with the budget.

Technical Advisor: Roy Brown reported that Federation-sponsored Proficiency Testing Program is underway

with 25 participants. Eight Societies are cooperating in Mildew Research Program by making sample paints and putting out for exposure. Roy was given green light to prepare program for 1985 Seminar (May 14-15, Baltimore) on painting new homes and maintaining and protecting appearance of existing homes.

1991 Annual Meeting and Paint Show: Board approved Executive Committee recommendation that 1991 Annual Meeting and Paint Show be held in Toronto, Ont., Canada, November 4-6—the only dates available in that city during Fall 1991. (NPCA will be in San Francisco, October 21-23).

Paint Research Institute: Board approved following recommendations of Executive Committee:

(1) That the Paint Research Institute not be dissolved (as recommended by the PRI Trustees) but kept alive for the purpose of maintaining the Roon Fund.

(2) That the name "Paint Research Institute" be changed to "Roon Fund."

(3) That the principal and interest of the Roon Fund be distributed in a manner consistent with the objectives of PRI.

(4) That the Federation Board of Directors (stockholders of PRI) elect the Executive Committee as Trustees of the "Roon Fund," with the intention that they would retain the Investment Committee to manage the Fund.

PRI Trustees must approve the name change and the accompanying changes in PRI By-Laws. If they do, PRI will become "Roon Fund" during Annual Meeting in Chicago.

In anticipation of change to "Roon Fund," President Terryl Johnson appointed Ad Hoc Committee to determine the research and educational, etc., areas in which the Federation should be engaged. (Past-President Howard Jerome is Chairman; Neil S. Estrada, Past-President and Chairman of Investment Committee; Dr. Thomas J. Miranda, President of PRI; Dr. Percy E. Pierce, PRI Trustee, and Saul Spindel, Chairman of Technical Advisory Committee). They will meet soon.

Society Business: Houston invited Federation to hold 1993 Annual Meeting and Paint Show in that city, on occasion of Society's 50th Anniversary.

Federation Honorary Membership: J.C. Leslie, President of Federation in 1974-75, was unanimously elected to Federation Honorary Membership by Board.

Nominations: The slate for 1984-85 presented by the Nominating Committee is:

President-Elect—Bill Mirick, of CDIC
Treasurer—Carlos Dorris, of Dallas
Executive Committee—Saul Spindel,
of New York (3 years)

Board (At-Large)—Jim Geiger, of
Southern (2 years)

Dick Kiefer, of Philadelphia (2 years)
Board (Past-President)—Mike Malaga,
of Cleveland (2 years)

Jim McCormick, of Baltimore, nominated John Emmerling, of Baltimore, as a Board Member-At-Large. (There will therefore be three candidates for the two positions).

Federation Office: Regarding the relocation of the Federation office in Philadelphia, the Board okayed the Executive Committee's recommendations to continue negotiations toward the purchase of office condominium space—conditioned upon approval of final terms by the Board. The purchase is of 8,000 sf of space on one floor of completely renovated building at 1608 Walnut St. (four blocks from present location) . . . 6,000 sf would be utilized for Federation offices . . . remaining 2,000 sf is for future growth, but for initial years, would be rented.

By-Laws: Proposed amendment providing the annual appointment of PRI Trustees as a specific duty of the Federation President was withdrawn.

Proposed amendment regarding staff participation in work of committees (Article V-C) was given first reading.

Annual Meeting and Paint Show: All plans going well for another "big one" in Chicago, October 24-26. Show will be biggest with 190 exhibitors in 45,000 net sf.



CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigment

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigments

CIBA-GEIGY
Quinacridone Pigments



The pros in quinacridones are wearing new hats

Our acquisition of Du Pont's Monastral[®] quinacridone pigments brought us more than just an excellent new product line. It brought us the professionals in quinacridone pigments. Most of the people involved with QA research and development, production, and technical service in Delaware have joined us. Together we will deliver the same products, the same quality, the same high level of service, research and development that you have come to expect from Du Pont.

For product information, call 302 998-9000 or write Quinacridone Products Group, CIBA-GEIGY Corporation, James & Water Streets, Newport, Delaware 19804. To place an order, call 800 431-2777 (in New York, 914 347-4700).

CIBA-GEIGY

Two Speakers to 'Kick-Off' 1984 Annual Meeting At Opening Session in Chicago

The Federation is pleased to announce that two prominent speakers, Pat Buchanan and Robert E. Pajor, will be featured at Wednesday's Opening Session at its 62nd Annual Meeting in Chicago, October 24-26.

The initial speaker, Pat Buchanan, is a leading political strategist and syndicated columnist, and will discuss "The 1984 Elections."

Mr. Buchanan was a senior staff assistant, press secretary, and speech writer during the "Nixon Years," serving Richard Nixon from his comeback campaign in the 60's to the final days of his Presidency in 1974.

The Keynote Speaker of the Annual Meeting, Robert E. Pajor, President and Chief Operating Officer of the Valspar Corp., will discuss "Meeting the Challenge of Managing Change."

Mr. Pajor joined Valspar's Industrial Coatings Div. in 1970, and has held the positions of Sales Manager, Marketing Manager, and Vice-President and General Manager of the division. He was named Executive Vice-President of the corporation in 1981 and elected to his present position the following year. Prior to joining Valspar, Mr. Pajor was with DeSoto, Inc. as a Chemist, Salesman, and Product Manager.

The Annual Meeting will open on Wednesday morning, October 24, in the Conrad Hilton Hotel, and Program Chairperson Darlene Brezinski, of DeSoto, Inc., has announced the theme, "Appearance and Protection—Essential to Our Lifestyle." She and her Program Steering Committee are developing a schedule of presentations around this topic.

Program Highlights

- Mattiello Lecture by Dr. Thomas J. Miranda, of Whirlpool Corp., "Reading the Signals of Society: Technology Push or Market Pull"
- Symposium on Color and Appearance
- Seminar on Filtration Technology
- Roon Awards competition papers
- Constituent Society papers
- Papers by affiliated overseas organizations

Paint Industries' Show

The 49th Paint Industries' Show will be held in conjunction with the Annual



Pat Buchanan



Robert Pajor

Meeting. The 1984 Paint Show is the largest in Federation history and will utilize all exhibit space in the Conrad Hilton (North, East, and West Halls, Continental Room, and International Ballroom).

The Show is the only national exhibit of raw materials and equipment used in the manufacture of paints and related coatings, and participating firms will have their top technical personnel on hand to discuss the latest developments in coatings manufacturing technology.

Exhibit hours will be 12:00 to 5:30 pm on Wednesday, October 24; 9:30 am to 5:30 pm on Thursday, October 25; and 9:30 am to 3:00 pm on Friday, October 26.

Headquarters Hotel

The Conrad Hilton will serve as headquarters hotel. Other hotels with blocks of rooms set aside for the Annual Meeting are the Americana Congress, Continental, Essex Inn, Hyatt Regency, McCormick Center, and Palmer House.

Room Reservations

All requests for rooms and suites must be sent to the Federation office on the official housing form which has been mailed to all members and is included in this issue (see pages 25-29). Additional housing forms are available from the Federation headquarters office.

Registration Fees

Advance registration is available for \$50 for members and \$65 for non-members. Fee for spouses activities is \$35 in advance.

Once again there will be a special registration fee of \$25 each for retired members and their spouses. This applies to advance registration only.

On-site registration fees will be \$60 full time and \$40 one day for members. Non-member fees will be \$75 full time and \$50 one day. Spouses registration will be \$45 on-site.

Registration forms were mailed to all members in April and are included in this issue (see pages 25-29).

Spouses Activities

Included in the spouses registration fee will be a get-acquainted champagne social on Wednesday afternoon; continental breakfast on Thursday and Friday at the Conrad Hilton; and a tour of Chicago with lunch featuring a unique and dazzling show of fashions by Chicago's leading designers.

Federation Luncheon

The Annual Federation Luncheon will be held Friday at the Conrad Hilton Hotel.

Presentations will be made to the recipients of the George Baugh Heckel Award (outstanding individual who has contributed to the advancement of the Federation) and the Flynn Awards (firms judged to have the best exhibit booths in the 1984 Paint Industries' Show).

Program Committee

Assisting Chairperson Brezinski on the Program Steering Committee are: Joseph A. Vasta (Vice-Chairman), of DuPont Co., Wilmington, DE; Gordon P. Bierwagen, of Sherwin-Williams Co., Chicago, IL; G. Dale Cheever, of General Motors, Warren, MI; Loren Hill, of Monsanto Co., Indian Orchard, MA; Joseph V. Koleske, of Union Carbide Corp., S. Charleston, WV; and Clifford Schoff, of PPG Industries, Inc., Allison Park, PA.

NPCA Meets Same Week

The National Paint & Coatings Association will hold its Annual Meeting on October 22-24, at the Palmer House.

The back-to-back scheduling of Association and Federation events provides coatings industry personnel with a full week of programming, specifically geared to their interests.

ANGUS CHEMICAL COMPANY

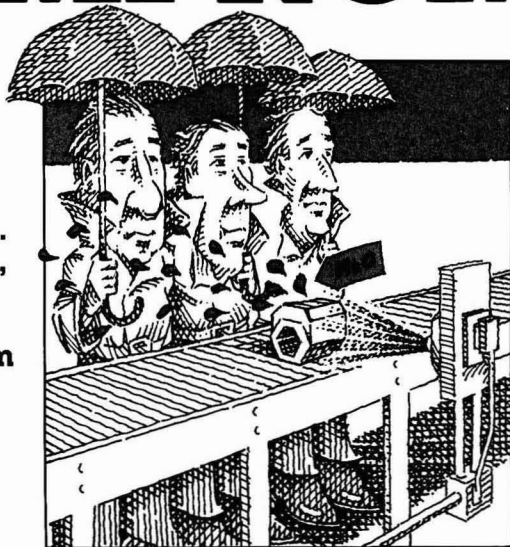
NO COMPROMISE

You demand a substrate dry enough for your epoxy coating to wet and coat uniformly every time. Why compromise, when ANGUS NiPar S-20™ can solve this problem and you also get:

- Increased flow during application
- More efficient wetting of the substrate
- More thorough pigment dispersion
- Increased film integrity

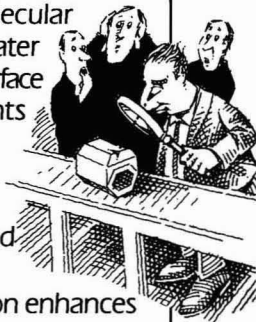
Specify ANGUS NiPar S-20. Its unique properties assure thorough wetting of surfaces and pigments by displacement of water, while providing other benefits during the manufacture, application and drying of epoxy coatings. ANGUS NiPar S-20 will improve the all-around performance of your solvent system, enhancing the ability of the coating to protect the substrate. Use the

coupon to order a sample of NiPar S-20 or call the sample desk direct (800) 323-6210, Illinois call collect (312) 498-6700.



ANGUS NiPar S-20 for epoxy coating formulations

ANGUS NiPar S-20 adds high adsorption energy to your solvent blend. It displaces the monomolecular film of water on the surface of pigments or substrates. Used in pigmented coatings,



a NiPar S-20 based formulation enhances the ability of epoxy resins to wet and coat pigment particles. A solvent blend with NiPar S-20 also promotes thorough drying to ensure dry-film integrity.

ANGUS™ NiPar S-20™
CHEMICAL COMPANY

FREE

Send technical information which describes the properties of ANGUS NiPar S-20™ in epoxy coatings, plus a sample of ANGUS NiPar S-20.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone (____) _____ Telex _____

Mail coupon to: ANGUS Chemical Company
2211 Sanders Road
Northbrook, IL 60062

ANGG

Coated Coil Rebounds in 1983; Prognosis Good for '84

A steady strengthening in key end-use markets in 1983, particularly during the last half of the year, has positioned the coil coating industry for significant growth in 1984.

The National Coil Coaters Association announced that strong customer activity during the fourth quarter of 1983 pushed full year shipment tonnage 22.5% ahead of 1982. Total estimated North American shipments of pre-coated steel and aluminum surged to 3.8 million tons, compared to 3.1 million tons in 1982. This was the third highest total in the industry's history despite a prolonged recession.

Coil coated steel shipments soared 23.4% from 1982 levels to 3.1 million tons, according to NCCA estimates, and estimated deliveries of coil coated aluminum jumped 18.5% to 731,000 tons of metal in 1983.

The National Coil Coaters Association compiles these estimates based on actual shipments reported to the association by both member and non-member companies. Figures are calculated for North American markets only.

NCCA member executives agreed that the impressive gains in 1983 reflect both the strength of the recovery in customer industries and increased penetration of these industries by coated coil. They look toward an improved business climate in 1984 and beyond.

Transportation

Transportation and building products remained the two largest markets for coated coil in 1983. Rebounding commercial and residential construction and increased auto sales spurred demand for pre-coated metal in these industries.

Steel pre-coated with weldable zinc-rich primers for passenger cars, trucks, and vans is the largest single tonnage product charted by the NCCA and accounted for over one million tons of coated coil in 1983. Automakers use the specially-coated steel heavily in their battle against rust.

Shipments of this product to the automotive industry jumped 34.9% last year compared to 1982. Coil coated steel deliveries to the entire transportation industry were up 33.5% overall.

Building and Appliance

Building products, the number two user of pre-coated steel, posted a more modest 25% tonnage gain for 1983.

Increased usage in preengineered buildings, rural building products, roof decking and metal doors and windows led the way. Portable buildings and parts, though still a relatively small end use, increased coated steel usage more than fourfold.

However, appliance manufacturers dramatically increased their use of coil coated steel during the year. Shipments to this industry skyrocketed 57.8%—far more than the increase in the number of units built. NCCA members indicated that the quality-conscious appliance makers are switching to pre-coated stock in new and renovated plant facilities.

Residential construction and renovation paced coil coated aluminum's recovery during 1983. Pre-coated aluminum posted a 13.5% increase in tonnage shipped to the building products industry, led by strong increases in residential soffit, fascia and trim (up 76.9%) and siding and roofing (up 41.4%).

Containers

Containers and packaging was close behind with an eight percent increase in

consumption of coil coated aluminum. The largest single tonnage use of pre-coated aluminum is metal cans, can ends and tabs; tonnage delivered to this market segment increased 7.4% in 1983.

NCCA members pointed out that key customer industries such as automobiles, construction and appliances are recovering from a multi-year recession. Coil coating industry leaders expressed confidence that stable interest rates combined with consumer confidence will lead to further gains in 1984.

Cosan Names Sales Agents

Cosan Chemical Corp., Carlstadt, NJ, has appointed the Jesse S. Young Co., Elizabeth, NJ, as sales agents for the firm's line of driers, anti-skinning agents, bactericides, fungicides, and chemical specialties for the paint industry. Included in the territory to be covered by Jesse S. Young Co. will be metropolitan New York, Long Island, and northern New Jersey.

Eastman Opens Chemicals from Coal Facility

Eastman Kodak's Chemical Division has opened facilities in Kingsport, TN, for the manufacture of chemicals from coal. Tennessee Eastman is the first manufacturer in the United States to develop and commercialize new chemical technology which utilizes coal as a raw material in the production of acetic anhydride.

The completion of the facilities culminates more than a decade of work by the company to investigate alternate raw material sources, develop new technology to manufacture acetic anhydride, acquire other necessary technologies from around the world, and design and construct the facilities. The use of coal substantially reduces the company's dependence on petroleum-related materials and will result in significant energy savings.

The new facilities have the capacity to daily convert 900 tons of coal from nearby Appalachian coal fields into synthesis gas, which is used as feedstock for making methanol and acetic anhydride. The methanol plant has an annual capac-

ity of 55 million gallons, some of which is used to produce methyl acetate, an intermediate used in acetic anhydride manufacturing. The new acetic anhydride plant can produce 500 million pounds of acetic anhydride annually, about half of the company's requirement.

Several plants and processes interact in the new facilities. A coal gasification plant, supplied with oxygen from a new air separation plant which was built, and is owned and operated by Air Products and Chemicals, Inc., produces gases from coal. Gases generated in the gasification plant are treated in a separation process to remove hydrogen sulfide and carbon dioxide from the gas stream. Further processing of the hydrogen sulfide converts it into sulfur which is sold to sulfuric acid manufacturers. Part of the carbon monoxide-hydrogen gas stream is processed to produce methanol. Next, the methanol is reacted with acetic acid to produce methyl acetate. The methyl acetate and carbon monoxide gas stream are then reacted to produce acetic anhydride.

Our newest advance in super dispersibility.
BENTONE*SD-2 for moderately polar systems.



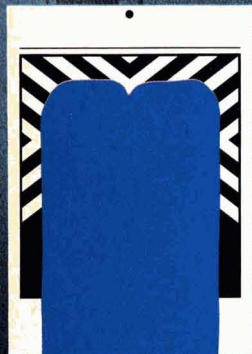
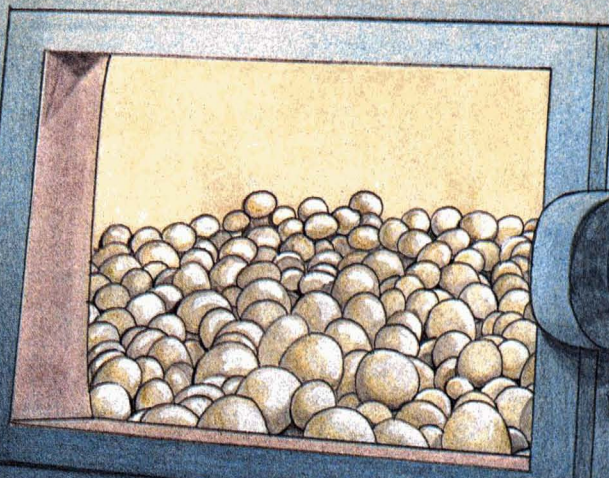
BENTONE SD-2 rheological additive is remarkably easy to use in moderately polar solvent systems such as ketones, glycol ethers, esters, alcohol. No need to pregel. No need for high shear. Simply add anywhere in the process, even during letdown. Same outstanding performance as provided by other BENTONE products. An excellent replacement for fumed silica.

Our proof is in the bottle. Mail the coupon, write or call.

NL Chemicals

BENTONE is a trademark of NL Industries, Inc. © 1983, NL Industries, Inc.

NL Chemicals/NL Industries, Inc. Box 700, Hightstown, NJ 08520.
Tel: 609 443-2500. Telex: 642240
NL Chem Canada, Inc. 2140 Sun Life Bldg.
Montreal, P.Q. Canada H3B 2X8. Tel: 514 397-3501
SEND LITERATURE SAMPLE BENTONE SD-2 RHEOLOGICAL ADDITIVE.
Name _____
Title _____
Company _____
Address _____
City _____
State _____
Zip _____



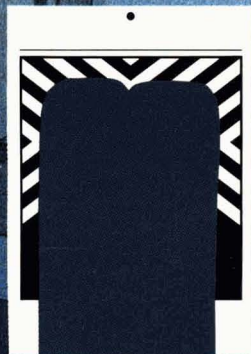
UNIFORMITY



CLEANLINESS



CONSISTENCY



PREDICTABILITY

Spartan still manufactures color concentrates with ball & pebble mills after 15 years for many reasons.

Quality assured from tinting to full color in most applications for rapid manufacturing of **small or large solvent-based batches**... and with dependable warehouse inventories stocked for **immediate shipment**.

1-800-231-4040

SPARTAN[®]

COLOR CORPORATION

5803 Northdale, Houston, Texas 77087 (713) 644-1964 (Texas only)

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Housing and Advance Registration Forms



62nd ANNUAL MEETING
49th PAINT INDUSTRIES' SHOW

CONRAD HILTON HOTEL • OCTOBER 24, 25, 26

1984 ADVANCE REGISTRATION

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

1315 Walnut St., Philadelphia, PA 19107

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

Please fill out this form and mail with a check in the correct amount (made payable to the FSCT) to the Federation address shown above. All checks must be payable in U.S. Funds. Any that are not will be returned. DEADLINE DATE FOR ADVANCE REGISTRATION IS SEPTEMBER 17. NONE WILL BE ACCEPTED AFTER THAT DATE.

A \$10.00 charge will be made for cancellations received prior to September 17. No refunds will be made after that date.

INDUSTRY REGISTRATION FEES:

A MEMBER \$50.00

Please name the Federation Society in which you are a paid-up member:

Federation Constituent Society

B NON-MEMBER \$65.00

G SPECIAL FEE FOR RETIRED MEMBERS \$25.00

Federation Constituent Society

INFORMATION FOR REGISTRATION BADGE:

NICKNAME

FIRST NAME _____ LAST NAME _____

BUSINESS AFFILIATION

STREET

CITY _____ STATE (U.S. only) _____

MAILING ZONE _____ COUNTRY (OTHER THAN U.S.) _____

BUSINESS CLASSIFICATION DATA FOR THE ABOVE REGISTRANT:

YOUR COMPANY (CHECK ONE BLOCK ONLY)

- AA Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants
- BB Manufacturers of Raw Materials
- CC Manufacturers of Equipment and Containers
- DD Sales Agent for Raw Materials and Equipment
- EE Government Agency
- FF Research/Testing/ Consulting
- GG Educational Institution/ Library
- HH Paint Consumer
- JJ Other

YOUR POSITION (CHECK ONE BLOCK ONLY)

- KK Management/ Administration
- LL Manufacturing and Engineering
- MM Quality Control
- NN Research and Development
- PP Technical Sales Service
- QQ Sales and Marketing
- RR Consultant
- SS Educator/Student/ Librarian
- TT Other

SPOUSES REGISTRATION AND INFORMATION FOR REGISTRATION BADGE:

D SPOUSE \$35.00

SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:

H \$25.00

NICKNAME

NAME

ADDRESS

CITY _____ STATE _____

MAILING ZONE _____ COUNTRY (OTHER THAN U.S.) _____

TICKETS FOR FEDERATION LUNCHEON, FRIDAY, OCTOBER 26 (@ \$20.00)

Z NUMBER REQUIRED: _____ \$20.00 EACH.

A CHECK IN THE AMOUNT OF:

\$ _____

IS ENCLOSED



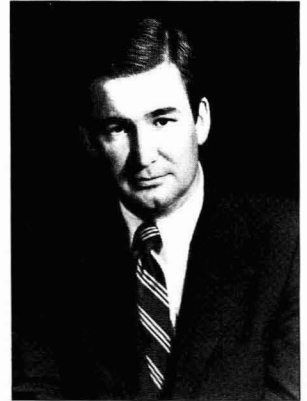
**1984 Annual Meeting
Paint Industries' Show
October 24, 25, 26
Conrad Hilton Hotel
Chicago, Illinois**

OPENING SESSION Wednesday, October 24

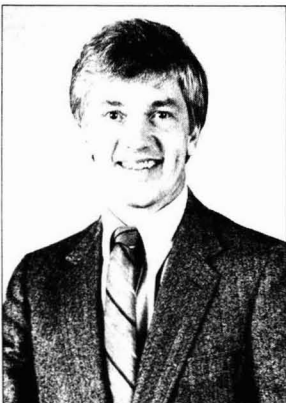
"The 1984 Elections"

Pat Buchanan

A leading strategist and syndicated columnist, Pat Buchanan will draw on his years of political experience as he addresses the Opening Session of the Annual Meeting. Mr. Buchanan served as senior staff assistant, press secretary, and speech writer during the "Nixon Years," from the comeback campaign to the final days of Nixon's Presidency in 1974.



Pat Buchanan



Robert E. Pajor

"Meeting the Challenge of Managing Change"

Robert E. Pajor

Robert E. Pajor, the Keynote Speaker of the Annual Meeting is President and Chief Operating Officer of the Valspar Corp. He joined Valspar's Industrial Coatings Division in 1970, and has held the positions of Sales Manager, Marketing Manager, and Vice-President and General Manager of the division. Mr. Pajor was named Executive Vice-President of the corporation in 1981 and was elected to his present position the following year.

**FSCT 1984 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
 CONRAD HILTON HOTEL, CHICAGO, ILLINOIS
 OCTOBER 24, 25, 26 (Wednesday, Thursday, Friday)
 APPLICATION FOR HOTEL ACCOMMODATIONS**

**MAIL Fed. Socs. Coatings Tech.
 TO: 1315 Walnut St.—Dept. H
 Philadelphia, PA 19107**

Please indicate below the type of accommodations requested and choice of hotels. All reservations will be processed by the Housing Bureau of the Chicago Convention & Visitors Bureau. Hotel assignments will be made in accordance with prevailing availability. The Housing Bureau will send you an acknowledgment, noting the hotel to which you have been assigned. The confirmation of your reservation will come to you directly from the hotel, to whom you must direct all inquiries.

All reservations will be held until 6:00 p.m. and none can be guaranteed after September 28.

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

CHOICE OF HOTELS:
1st
2nd
3rd
4th

NAMES AND ADDRESSES OF ROOM OCCUPANTS AND DATES OF ARRIVAL DEPARTURE

Type of Room	Name	Address	Dates	
			Arrive	Depart

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

SEND CONFIRMATION FOR ALL RESERVATIONS TO:

Name _____

Company _____

Address _____

City _____ State or Province _____

Country _____ Mailing Code _____

Telephone _____

Note: Requests for accommodations at the Conrad Hilton will be limited to five rooms per company. A parlor counts as one room.

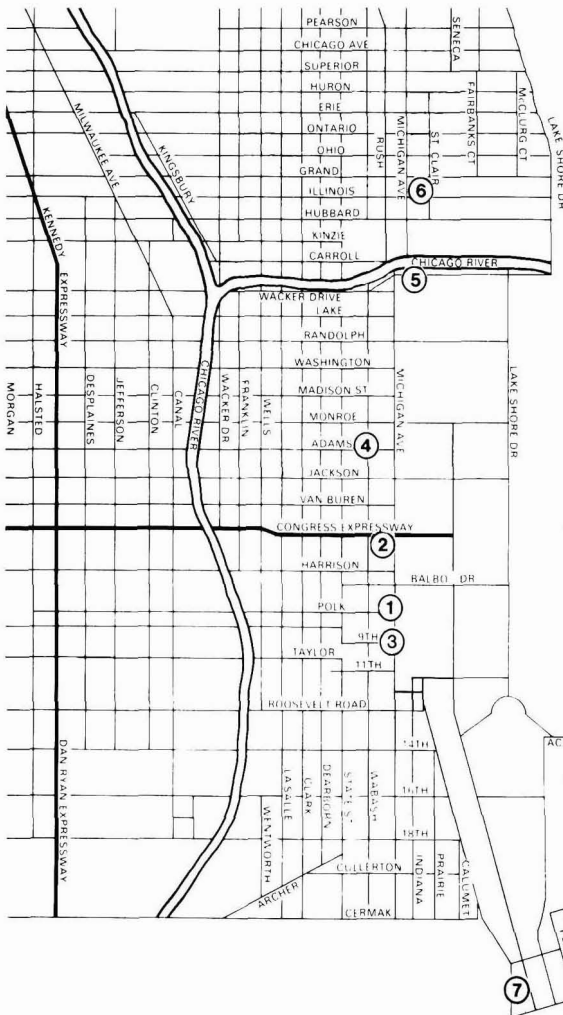
HOTEL INFORMATION AND RATES

All Room Rates Are Subject to a City and State Tax of 9.1%.

Hotel	Singles	Doubles Twin	Parlor & 1 Bedroom	Parlor & 2 Bedrooms
* Conrad Hilton	65-71-82-86-97	81-97-98-102-113	100 to 355	255 to 475
* Conrad Hilton Towers	82-102	98-118	"	"
Americana Congress	55	65	85 to 300	175 to 400
Continental	70	85	175 to 240	240 to 450
Essex Inn	46-54-60-66	56-64-70-76		
Hyatt Regency	94-104-114-124	109-119-129-139	175 to 525	275 to 625
McCormick Center	68-78-86-96-104	80-90-98-108-116		
†Palmer House	75-90-105-115-130	95-110-125-135-150	165 & up	395 & up

* Requests for accommodations at the Conrad Hilton will be limited to five rooms per company. A parlor counts as one room. Additional reservations will be assigned to other cooperating hotels.

† Reservations for the Palmer House will be accepted for arrival beginning Wednesday only.



DOWNTOWN MAP CHICAGO

- 1 Conrad Hilton
- 2 Americana Congress
- 3 Essex Inn
- 4 Palmer House
- 5 Hyatt Regency Chicago
- 6 Continental
- 7 McCormick Inn

We're helping Detroit's 7 million unit auto industry weather the competition.

Today more than ever, it is essential that the American automotive industry produce vehicles that offer the greatest

possible value for the dollar. Reichhold is playing a major role in that effort by providing the auto makers with specialty chemicals that bring new efficiencies and higher quality standards to their manufacturing procedures.

For example, our advanced binder systems enable highly efficient application of undercoating paints. Our thermoplastics make it possible to produce bumper guards that are strong yet lightweight. And our phenolic resins can be found hard at work in brake linings, brake pistons and switching gear. In fact, from the headlights to the tail lights—both inside and out—high-performance Reichhold products are helping give the auto industry a new competitive edge.

But Detroit is only one place where Reichhold Performance Technology is helping set a new pace. From coast to coast and border to border, we're serving many of today's fastest moving industries. To learn the full scope of our involvement, contact: Reichhold Chemicals, Inc., 525 North Broadway, White Plains, NY 10603.

REICHHOLD®

PERFORMANCE TECHNOLOGY



Characterization of the Variability In Corrosion Resistance of Steel Using Electrochemical Techniques

R.G. Groseclose, C.M. Frey, and F.L. Floyd
Glidden Coatings and Resins, Division of SCM Corporation*

In testing paints for corrosion resistance, coating companies have had to cope with the variability of the metal test substrate. Previous methods in the literature to quantify steel quality and variability are time consuming and expensive. A novel and quick electrochemical technique has been developed using anodic polarization of metal test specimens in a mildly corrosive electrolyte. This has led to an electrochemical profile of the uncoated steel that can predict the relative salt spray performance of the coated panel. The variability of hot rolled steel has also been quantified. Additional characterization was carried out on abrasively polished and sand-blasted steel. Such mechanical cleaning was shown to dramatically reduce the variability of the steel.

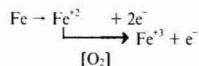
INTRODUCTION

The corrosion resistance of a coated metal panel is a composite of the steel quality, its surface preparation or pretreatment, and the properties of the coating. Recently, investigators in the auto, appliance, and steel industries have concluded that carbonaceous deposits found on the surface of the steel can be related to the variable performance of the coated panels in salt spray testing.¹⁻⁴ The carbon contamination has been traced to the rolling oils which become bound to the coil surface during batch annealing.⁵ The common techniques for determining the cleanliness of the steel have been Auger Electron Spectroscopy and ESCA (Electron Spectroscopy for Chemical Analysis).⁶ While these techniques work well, the instrumentation is expensive and not well-suited to routine use in quality control.

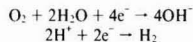
The purpose of this paper is to present electrochemical techniques for assessing both the quality and variability of cold rolled steel (CRS) and hot rolled steel (HRS), as well as the effect of various mechanical surface treatments—sandblasting and abrasive polishing.

THEORY

When a piece of metal corrodes it contains active anodic and cathodic sites. For iron immersed in water containing oxygen, the following reactions take place at the anode:



This leads to dissolution of the iron substrate. At the cathode, the corresponding reactions are:



Electrochemical techniques offer a way to accelerate the rate of corrosion as well as to look at the anodic and cathodic reactions separately. The two quantities used to characterize an electrochemical reaction are current and potential. The "corrosion potential" (E_{CORR}) of a given metal specimen is measured by determining the voltage difference between a metal immersed in a corrosive media and an appropriate reference electrode (such as a saturated calomel electrode). A metal at E_{CORR} is at equilibrium with its environment; the anodic and cathodic currents are equal in magnitude, so there is no net current flow. As the potential of the metal is changed in the positive direction (anodic) or the negative direction (cathodic) relative to E_{CORR} , a current can be measured. This is displayed in *Figure 1*. If the specimen is polarized slightly in the positive direction, the anodic current predominates at the expense of the cathodic current. As

*16651 Sprague Rd., Strongsville, OH 44136.

Presented at the 60th Annual Meeting of the Federation of Societies for Coatings Technology, November 4, 1982, in Washington, DC.

Correspondence should be addressed to Dr. Floyd.

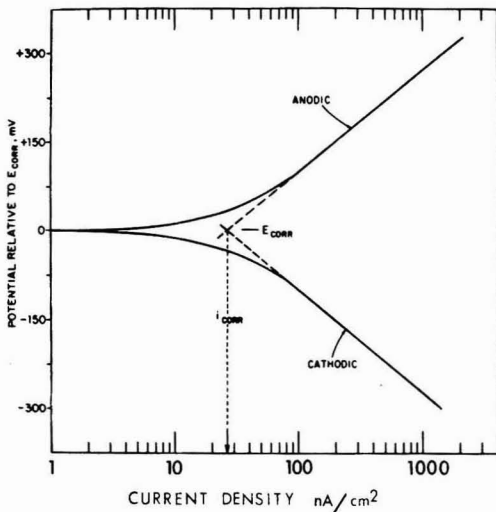


Figure 1—Idealized plot of potential vs current. (From reference 8)

the specimen potential is driven further positive, the cathodic current component becomes negligible. When the resultant potential-current function is plotted on semi-log paper, it usually exhibits a linear region for both cathodic and anodic plots (Figure 1). A projection of the linear region defines i_{CORR} at the intersection with E_{CORR} .⁷

Potentiodynamic Polarization

In potentiodynamic polarization techniques the metal specimen is scanned in the anodic direction (positive to E_{CORR}) or the cathodic direction (negative to E_{CORR}). This allows one to study the corrosion performance of the metal as either an anode or cathode. Investigations of passivation tendencies and effects of inhibitors or oxidizers are easily performed with this technique. Examples of several potentiodynamic scans are given in Figure 2, with each number representing a separate anodic and cathodic scan. If each plot represents a separate metal specimen, the following statements could be made about their corrosion resistance:

- (1) The more positive the corrosion potential (E_{CORR}), the easier the metal can be oxidized and form a passive iron oxide film (i.e., Sample 1 will corrode less than Sample 2).
- (2) If two metal specimens have the same corrosion potential, the sample with the lower current (i_{CORR}), (2) compared to (3), would corrode less.

Similar guidelines can be developed for the influence of various electrolytes on corrosion (Brasher⁹ and Morris¹⁰). The situation is slightly more complicated when the metal specimen exhibits passive behavior over an entire potentiodynamic scan. Figure 3 is an idealized example of two different metal samples with the same E_{CORR} , yet Sample a has relatively little change in current (around 5×10^3 nano-amps/cm²) over a fairly wide change in potential. This is an example of passive behavior. Sample

b has continuing rising currents during the scan. Thus Sample a would corrode less than Sample b.

EXPERIMENTAL

Test Specimens and Cleaning Procedures

Sandblasted cold rolled steel (CRS) and hot rolled steel (HRS) as well as untreated HRS, were obtained from a commercial steel fabricating shop. Polished and unpolished 4" x 12" CRS panels were obtained from a commercial source known for consistency of product. Test coupons (2" x 4") were cut immediately before electrochemical measurements and were degreased for five minutes in boiling xylene. For systems that were to be electrochemically cleaned, the degreased test panel was placed in the electrochemical cell with 100 mL of the test electrolyte and cathodically cleaned for 30 seconds by keeping the potential at -2.0 volts below E_{CORR} . The test electrolyte was then removed and the cell rinsed several times with deionized water. Fresh test electrolyte (100 mL) was then added and the electrochemical measurements performed.

Electrolyte Solutions

The 5% NaCl solution was prepared from analytical grade salt and deionized water. The 0.025 m sodium tetraborate, 0.01 m sodium chloride, and pH 9.3 buffer were prepared from analytical grade chemicals obtained from common commercial sources.

Test Cell

All measurements in this paper were carried out using the test cell shown in Figure 4. The cell is a 47 mm x 152 mm long Pyrex pipe with a TFE gasket which is clamped to the metal substrate (2" x 4" test coupon). This exposes a portion of the metal sample, 38 mm in diameter (1.19 cm²), to the test electrolyte. The two counter electrodes are high density graphite rods and the reference electrode is a standard calomel type. To avoid contamination, the

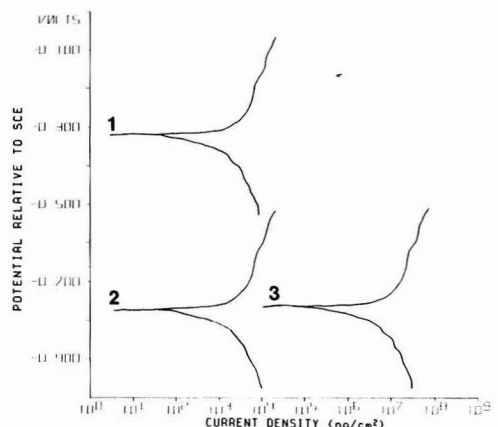


Figure 2—Idealized potentiodynamic scans showing differences in E_{CORR} and i_{CORR}

Table 1—Test Conditions

Method #	Electrolyte	Electrochemical Cleaning
Anodic Polarization:		
1	NaCl/Borate	Yes
2	NaCl/Borate	No
3	5% NaCl	Yes
4	5% NaCl	No
Cathodic Polarization:		
5	NaCl/Borate	Yes
6	NaCl/Borate	No
7	5% NaCl	Yes
8	5% NaCl	No

reference electrode makes contact with the solution through a remote reference junction.

Test Instrumentation and Conditions

The test instrument was a Princeton Applied Research (Princeton, NJ) Model 350 (PAR-350) computerized corrosion measurement system. All scans were run at 0.1 mv/sec. The anodic polarization measurements were carried out from E_{CORR} to $E_{CORR} + 250$ mv. For cathodic polarization the range was E_{CORR} to $E_{CORR} - 250$ mv. Different metal test specimens were used for anodic vs cathodic scans. All samples were equilibrated in the test electrolyte for 30 minutes before electrochemical testing. Eight different test methods were tried (Table 1). The variables were: type of scan, test electrolyte, and metal pre-cleaning. In addition to the equilibration time, an anodic or cathodic polarization required 45 minutes.

Salt Spray Testing

Five different lots of CRS were tested in salt spray and electrochemically. Half a CRS panel ($4" \times 12"$) was coated with a test primer and the other half retained for electrochemical testing. This way the same panel could be tested in salt spray (coated) and on the corrosion meter (uncoated).

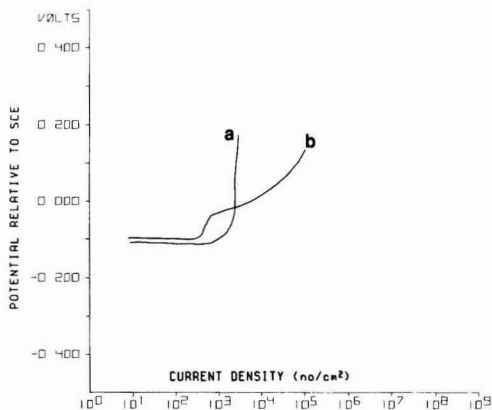


Figure 3—Idealized anodic potentiodynamic scans showing differences in passivation

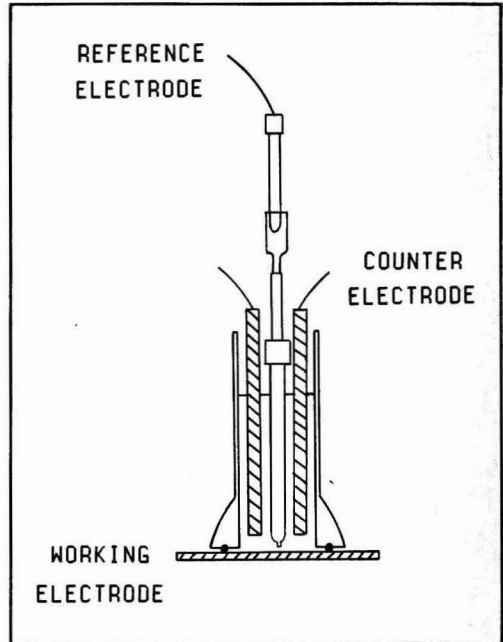


Figure 4—Electrochemicals test cell

Five drawdowns each of three different water-based primers (Table 2) were made with a 6 mil Bird blade for each lot of CRS. The panels were hand cleaned with MEK prior to coating. Dry film thickness was 2.7–3.0 mils. After drying seven days, the backs and edges of the scribed panels were primed with a heavy duty solvent-based primer and placed in salt spray. Panels were rated

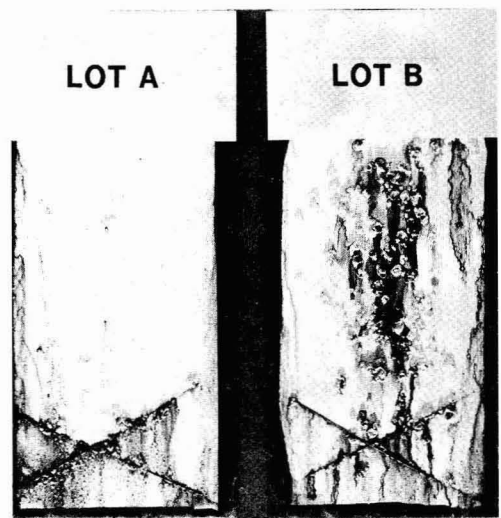


Figure 5—Five hundred hours salt spray of primer 1C over two different lots of CRS. Each panel illustrated is representative of twelve panels

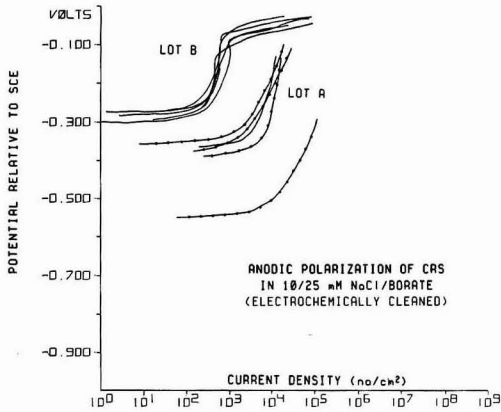


Figure 6—Anodic polarization of electrochemically cleaned steel in a borate/chloride buffer

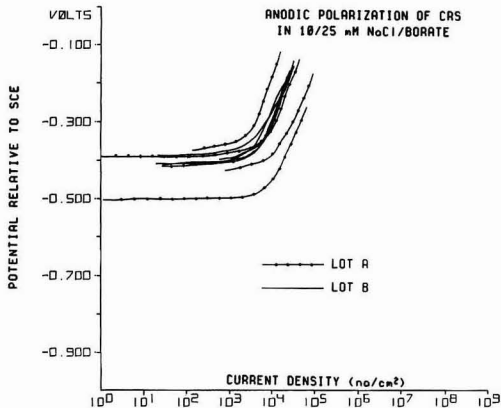


Figure 7—Anodic polarization of steel in a borate/chloride buffer

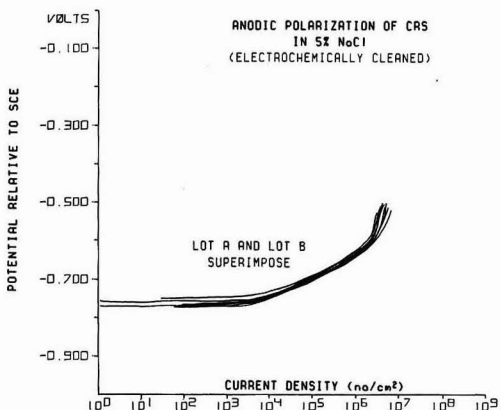


Figure 8—Anodic polarization of electrochemically cleaned steel in 5% NaCl

Primer	Description
IA	Acrylic latex, no reactive pigment
IB	Commercial latex primer, barium metaborate
IC	Acrylic latex, zinc phospho-oxide, zinc molybdate

at 144, 334, and 504 hours depending on the performance of the primer.

Blister size and density was rated according to ASTM Method D-714-56. Rusting was rated on a scale from 10 to 0 where 10 = no rusting. The rust and blister ratings were combined to give an overall salt spray rating as follows:

$$\text{Salt Spray Rating} = \frac{(\text{Blister Density} \times \text{Rust}) + \text{Blister Size}}{10}$$

Blister density—ASTM rating 10 = none, 0 = dense.
Blister size—ASTM charts—the larger the number, the smaller the blister.

The larger the salt spray number, the better the performance of the panel.

Regression Analysis

The BMPD statistics package of the University of California was used to correlate data. A correlation option was employed to look for correlations between salt spray and electrochemical measurements. Values of the correlation coefficient, *r*, and confidence levels (100 – significance) were calculated. Correlations were carried out on the average salt spray rating for a lot of steel vs the average electrochemical rating for the same lot of steel.

RESULTS AND DISCUSSION

Workers in the paint industry have known for some time that the same paint can have dramatically different performance in salt spray when tested over different lots of steel. An example of this can be seen in Figure 5. This represents 500 hours salt spray of a water-borne primer

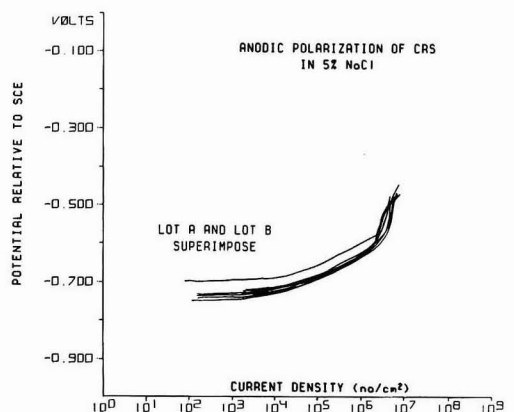


Figure 9—Anodic polarization of steel in 5% NaCl

(primer 1C) over two different lots of CRS. For simplicity, lots are designated A and B. The panels illustrated are representative of 12 panels in each lot.

Selection of Test Conditions

Most electrochemical testing of steels has involved the study of new alloys. Very little work has been done to develop a technique to evaluate the quality of 1010 or 1020 cold rolled steel.⁴ In order to develop a test method, we used two lots of CRS (lot A and lot B) that we had previously tested with coatings in salt spray and had shown different results with the same coating (Figure 5). The goal of our test method development was to maximize the differences between the two lots of steel.

ANODIC POLARIZATION: The results from the anodic polarization testing are given in Figures 6-9. Four different test procedures were tried: scans in either NaCl or borate/chloride and with and without electrochemical cleaning. As we can see from Figures 6 and 7, testing in a mildly corrosive solution (borate/chloride) showed more differentiation between the two lots of steel. In Figures 8 and 9, we can see that the highly corrosive 5% NaCl swamps out the differences between the two lots. This was also found by previous workers who tried to determine steel quality by anodic scans in NaCl.⁴ The electrochemical cleaning of the sample is also important. When the sample is not electrochemically cleaned, it is covered by a thin oxide layer which apparently can mask differences in the underlying steel. (Figure 6 vs 7).

CATHODIC POLARIZATION: The data for the cathodic polarization measurements are given in Figures 10-13. Again, of the four techniques tried, the use of the borate/chloride electrolyte and electrochemical cleaning showed the largest differences between the two lots of steel. The cathodic curves have, however, more overlap between the two lots of steel than the corresponding anodic curves (Figure 10 vs Figure 6). Thus, the cathodic scans do not provide as much discrimination as the anodic scans.

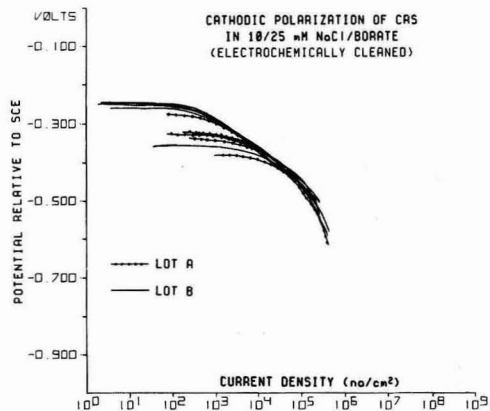


Figure 10—Cathodic polarization of electrochemically cleaned steel in a borate/chloride buffer

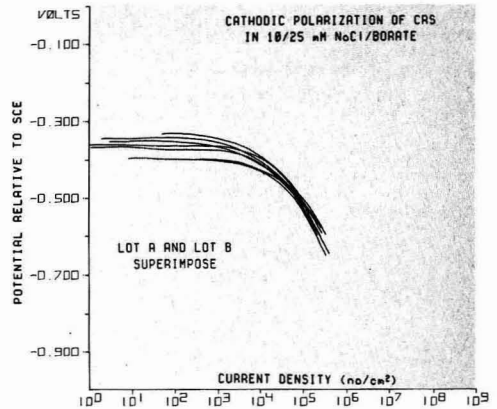


Figure 11—Cathodic polarization of steel in a borate/chloride buffer

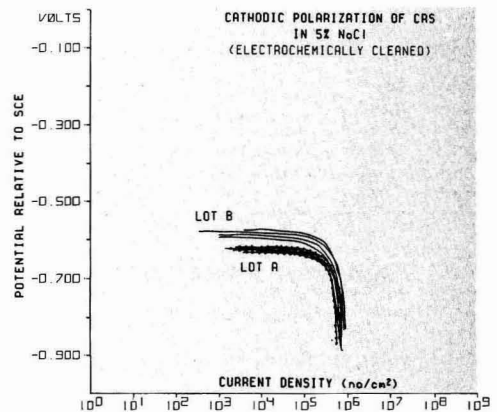


Figure 12—Cathodic polarization of electrochemically cleaned steel in 5% NaCl

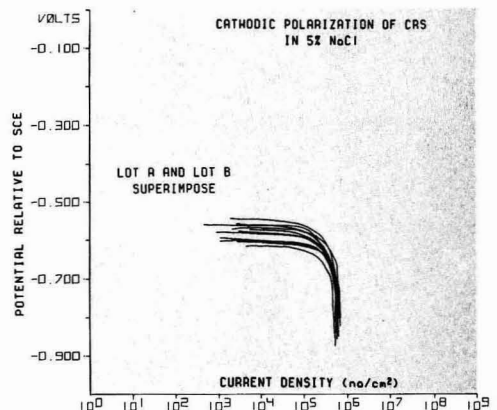


Figure 13—Cathodic polarization of steel in 5% NaCl

Table 3—Ranking of Steel Quality (Salt Spray Data)^a

Primer 1A, 144 hr Salt Spray

Lot #	Salt Spray Rating
1	6.9 ± 1.0
2	6.6 ± 1.0
3	5.6 ± 0.8
4	4.6 ± 0.9
5	4.3 ± 0.6

Ranking: 1 ~ 2 > 3 > 4 ~ 5

Primer 1B, 334 hr Salt Spray

Lot #	Salt Spray Rating
2	4.9 ± 0.8
3	4.3 ± 0.2
1	4.2 ± 0.2
4	3.1 ± 0.5
5	2.8 ± 0.1

Ranking: 2 > 3 ~ 1 > 4 ~ 5

Primer 1C, 504 hr Salt Spray

Lot #	Salt Spray Rating
3	8.6 ± 0.2
1	7.7 ± 0.2
2	7.6 ± 0.1
4	5.5 ± 1.1
5	3.9 ± 0.2

Ranking: 3 > 1 ~ 2 > 4 > 5

Overall Ranking:

- 3 good lots 1 ~ 2 ~ 3
- 2 poor lots 4 > 5

(a) Salt spray numbers represent average for five panels for each lot, ± one standard deviation.

Assessment of Steel Quality

The data in Figures 6–13 indicate that anodic scans of electrochemically cleaned CRS in a mildly corrosive buffer yield the greatest difference between two lots of

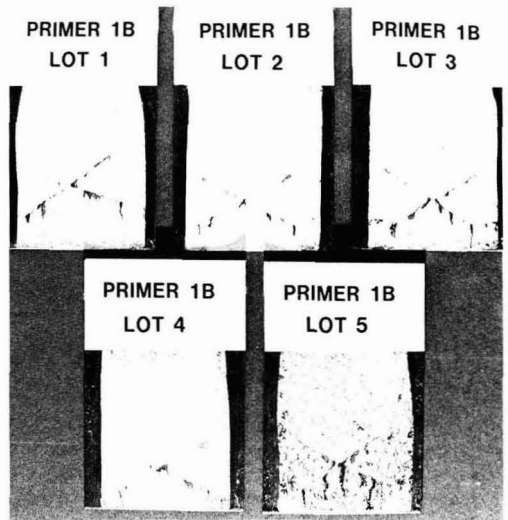


Figure 15—Representative salt spray panels for primer 1B. (334 hours salt spray)

steel that had previously shown different salt spray performance. Looking at the data in Figure 6 in more detail, we can see that lot A steel has higher i_{CORR} 's and lower (more negative) E_{CORR} 's than lot B steel. Based on previous qualifications in the literature, (references 9 and 10) this would tend to make us judge lot A steel to be poorer in quality than lot B steel. However, all the panels from lot B steel show a breakdown in passivation (increase in current) about two thirds of the way through the scan. We know from salt spray testing that lot B was poorer than lot A; therefore, we decided to study several additional lots of steel to see if this breakdown in

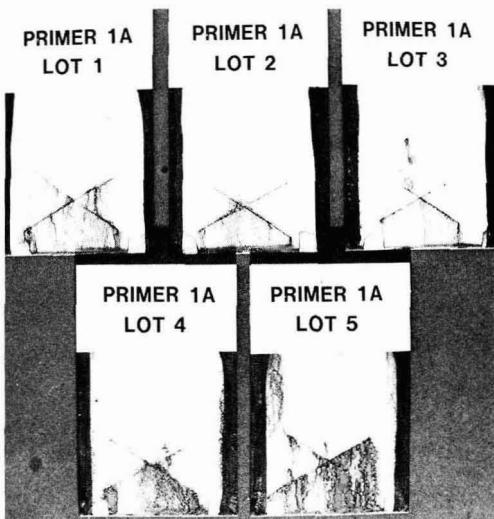


Figure 14—Representative salt spray panels for primer 1A (144 hours salt spray)

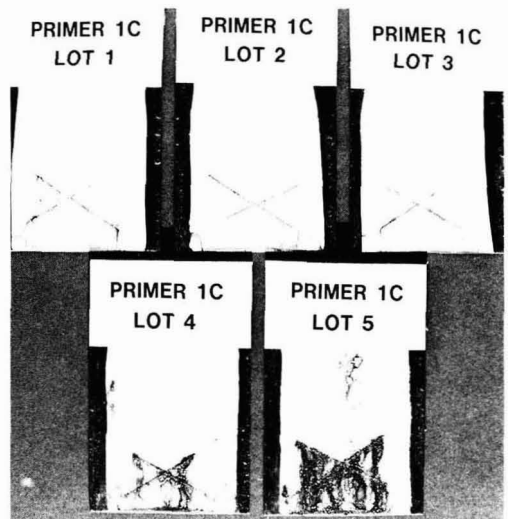


Figure 16—Representative salt spray panels for primer 1C. (504 hours salt spray)

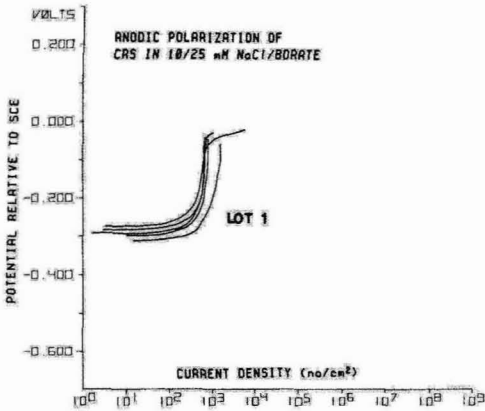


Figure 17—Anodic polarization of electrochemically cleaned steel (lot 1) in a borate/chloride buffer

passivation was a characteristic electrochemical profile that could predict poor salt spray performance.

Table 3 contains the ranking of steel quality of five additional lots of CRS as determined by salt spray performance. Five panels were run in each lot. Panels were rated at different times depending on the quality of the primer. Basically, lots 1, 2, and 3 performed about the same in salt spray. The paints drawn down over lots 4 and 5 exhibited considerably more failure. This can be seen visually in Figures 14–16.

The bottom halves (uncoated) of the same panels that were tested in salt spray were then run on the PAR-350 corrosion meter. This yielded fifteen panels per lot of steel.

Representative traces for lot 1 and lot 5 can be seen in Figure 17 and 18.

In general, the "good" lots of steel (lots 1, 2, and 3) had scans similar to Figure 17. The panels exhibited passivation (i.e., nearly constant current) over most of the 250 mv anodic scan. The poor steel panels exhibited loss of passivation at different potentials in the anodic scan. This was quantified as seen in Figure 19. The region from a to b

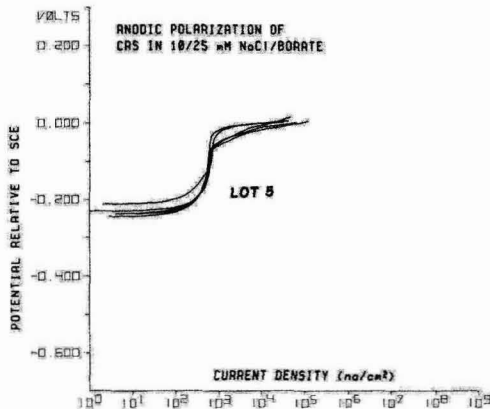


Figure 18—Anodic polarization of electrochemically cleaned steel (lot 5) in a borate/chloride buffer

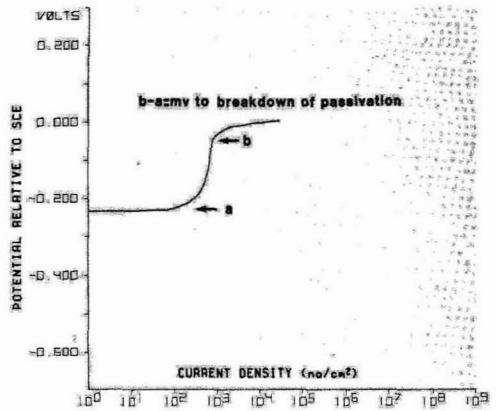


Figure 19—Determination of millivolts (MV) until breakdown in passivation

indicates the total number of millivolts of passive behavior. For a panel that did not fail, the number of millivolts of passive behavior was arbitrarily set at 250 mv (i.e., the entire scan). Thus the larger the difference between a and b, the greater the tendency for the steel to passivate. The electrochemical ranking of the five lots of steel can be seen in Table 4. Failure is defined as the breakdown in passivation. Panels were ranked according to the number of panels which exhibited passive behavior as well as the average millivolts of passive behavior for each lot. We can see that lots 1 and 2 are fairly similar with lots 4 and 5 having poorer performance. Thus the ordering of three lots of "good" steel and two lots of "poor" steel is the same as salt spray testing. We also noticed that whenever a panel exhibited the electrochemical behavior profiled in Figure 18, (i.e., breakdown in passivation), the CRS coupon, when removed from the test cell, was found to contain very localized rust spots as seen in Figure 20. Examination of these spots under a microscope revealed pitting of the steel, suggesting that the failure to passivate was due to inclusions in the steel.

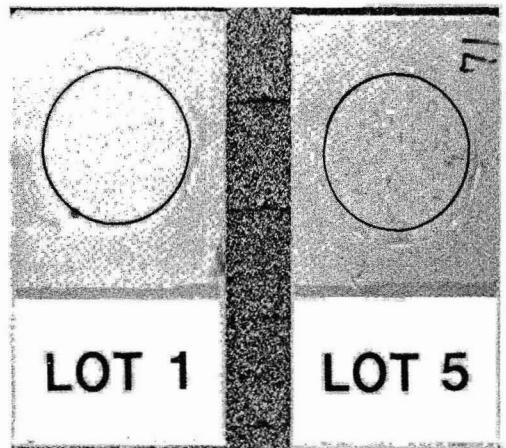


Figure 20—Cold rolled steel after anodic polarization measurements in borate/chloride buffer. Circles indicate cell placement

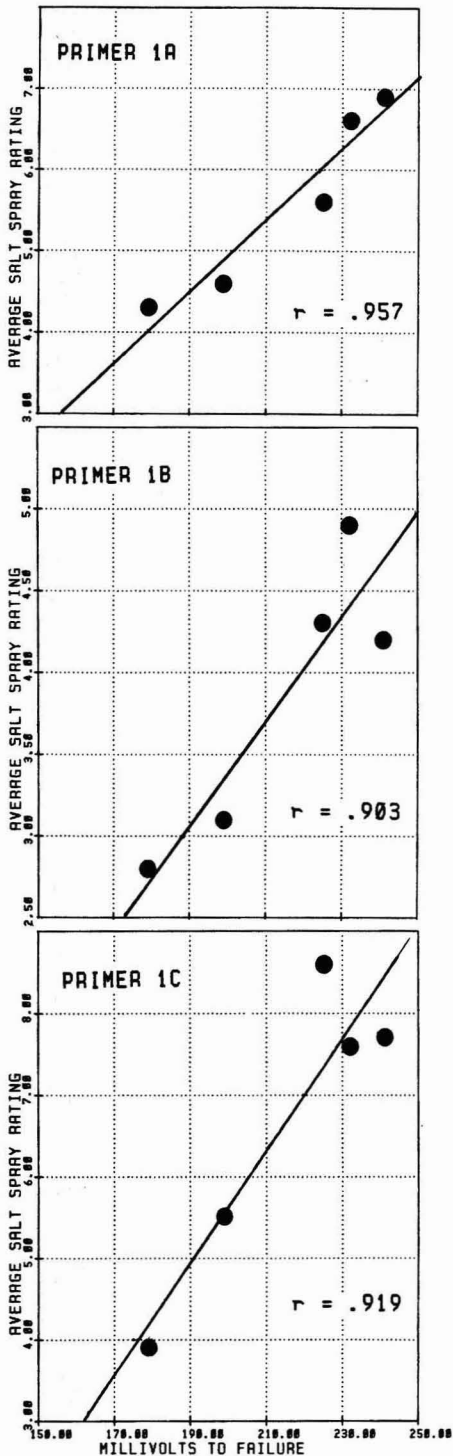


Figure 21—Correlation of average salt spray ratings vs mv to failure for three different primers

Table 4—Ranking of Steel Quality Electrochemically

Lot #	Average mv ^a to Failure	% Panels Which Did Not Fail
1	.241 ± 12	60%
2	.232 ± 24	53%
3	.225 ± 24	40%
4	.199 ± 24	0
5	.179 ± 16	0

Ranking: 1 ~ 2 > 3 > 4 ~ 5

(a) Fifteen panels evaluated for each lot. Average reported ± one standard deviation. Panels which did not fail assigned a value of 250 mv.

Single variable correlations were run between average salt spray and the average millivolts-to-failure for all three primer systems. A graphical representation can be seen in Figure 21.

The correlations are all quite high ($r > 0.9$). Figure 22 contains the data for a composite of all three primer systems. Again the correlation is quite good. (See Table 5.)

Assessment of Steel Variability

The work in the previous sections shows that we can make judgements on the quality of CRS test panels. We have also shown that the paint can compensate for some differences in E_{CORR} and i_{CORR} , but not for steel panels that do not passivate.

The remainder of the paper is concerned with using electrochemical profiling to study the variability of CRS or HRS (hot rolled steel) that has received different mechanical treatment. Only anodic scans of electrochemically cleaned steel in the borate/chloride buffer were studied. No attempt was made to compare the electrochemical data to salt spray.

SINGLE PANEL OF CRS: As we saw in the previous section, there can be considerable variability. Within a single CRS panel, however, the variability is rather low. Figure 23 represents five samples cut from the same panel. Several of the scans superimpose on one another. We are also looking at a greatly expanded scale—the y axis is 300 millivolts, whereas it was a full volt in previous figures. Figures 24 and 25 contain data for the same lot of CRS and several additional lots of steel, respectively. All data are plotted with the expanded potential axis. As the data in Figures 24 and 25 show, there is considerably more variability within a lot and even more between different lots of steel.

POLISHED STEEL: It is known that abrasive cleaning of CRS will remove the carbonaceous deposits on the

Table 5—Correlation of Salt Spray vs Millivolts-to-Failure

System	r	Confidence Level (%)
Primer 1A	.0.957	99
Primer 1B	.0.903	96.5
Primer 1C	.0.919	97.3
Average of all 3 primers	.0.980	99+

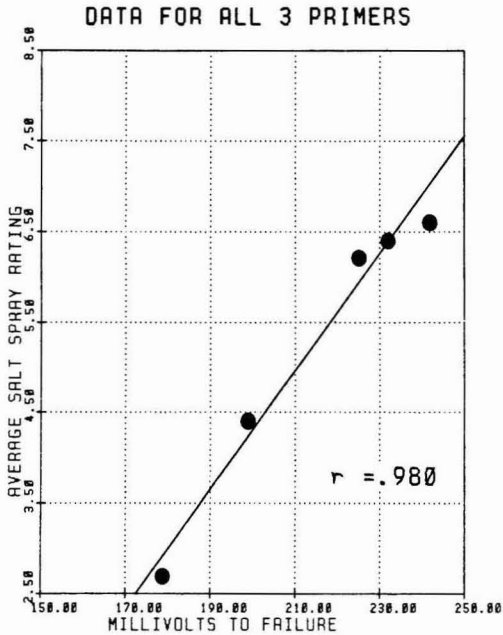


Figure 22—Correlation of salt spray ratings (average of all 3 primers) vs mv to failure

surface and thus yield a more uniform surface for phosphating and painting.¹¹ This uniformity can be seen in Figures 26–28. We can see that panel-to-panel and lot-to-lot variability are very low. In fact, the lot-to-lot variability for the polished CRS is equivalent to the variability seen in a single unpolished CRS panel.

FABRICATOR SHOP CRS: Thus far, most of our work on CRS has been on steel obtained from a commercial supplier of steel panels, which specializes in steel of great uniformity for test purposes. However, steel that most

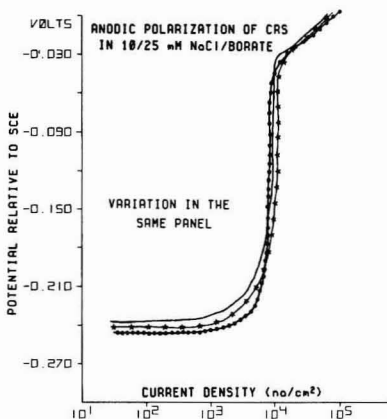


Figure 23—Anodic polarization of electrochemically cleaned steel from the same CRS panel

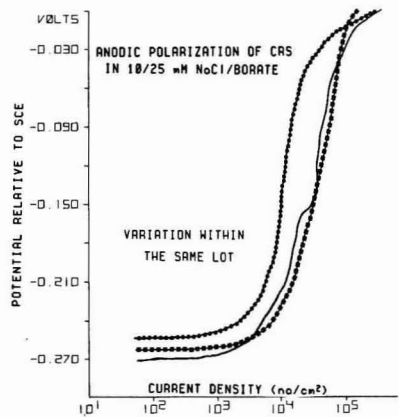


Figure 24—Anodic polarization of electrochemically cleaned steel from the same lot of CRS panels

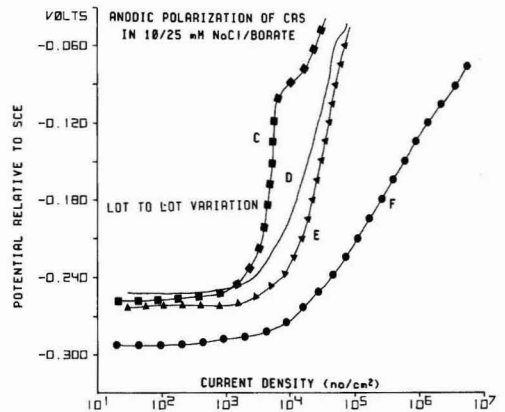


Figure 25—Anodic polarization of electrochemically cleaned steel from different lots of CRS panels

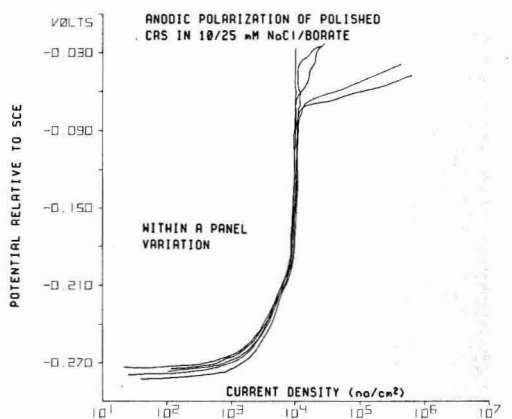


Figure 26—Anodic polarization of electrochemically cleaned steel from the same polished CRS panel

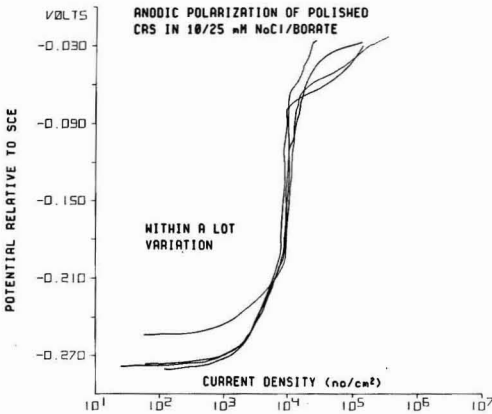


Figure 27—Anodic polarization of electrochemically cleaned steel from the same lot of polished CRS panels

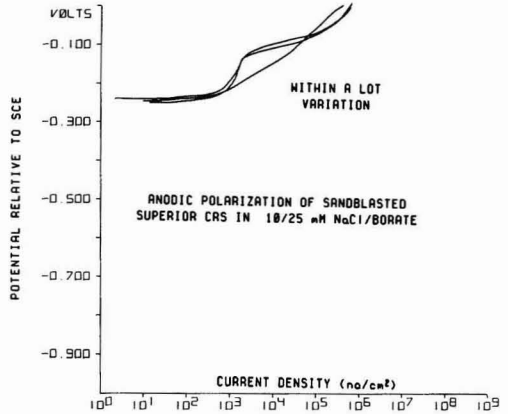


Figure 30—Anodic polarization of electrochemically cleaned fabricator shop sandblasted CRS

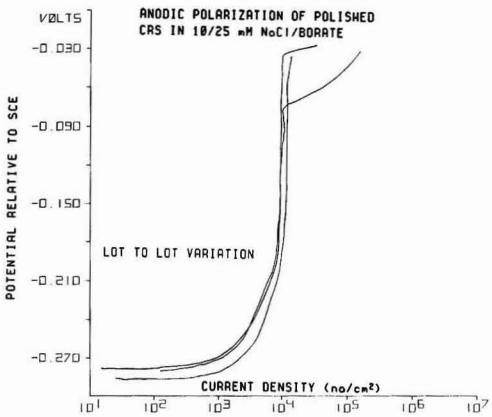


Figure 28—Anodic polarization of electrochemically cleaned steel from three different lots of polished CRS panels

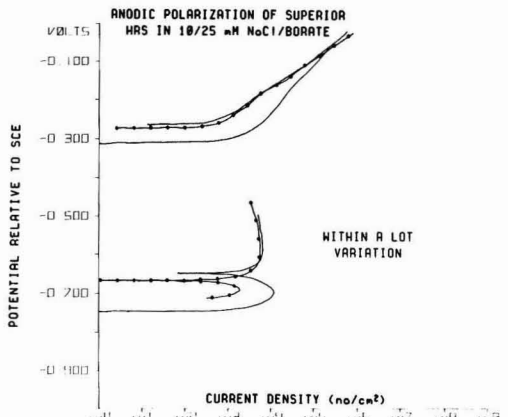


Figure 31—Anodic polarization of electrochemically cleaned fabricator shop HRS

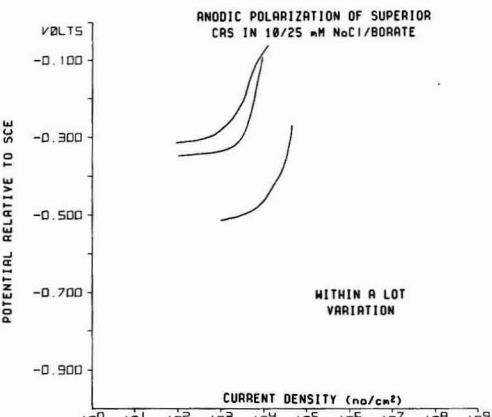


Figure 29—Anodic polarization of electrochemically cleaned fabricator shop CRS

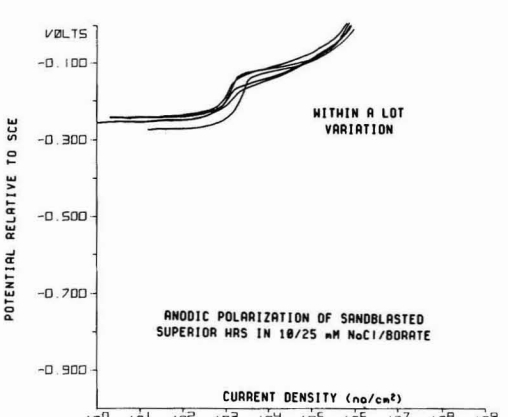


Figure 32—Anodic polarization of electrochemically cleaned fabricator shop sandblasted HRS

coatings companies paint in the field probably deviates considerably from this ideal. *Figure 29* contains scans of CRS panels (same lot) from a fabricating shop. While the three panels have different E_{CORR} 's and i_{CORR} 's they all passivate in the borate/chloride buffer.

SANDBLASTED CRS: *Figure 30* contains scans for sandblasted CRS (near white blast). We might expect sandblasting to have two effects on the surface of the steel. First, the blasting would create a greater surface area, which would lead to a greater current flow. Secondly, the surface oxides and carbon deposits would be removed. Since both species are cathodic to pure iron¹² their removal should yield steel with higher E_{CORR} 's (i.e., less negative). The scans in *Figure 30* have both higher E_{CORR} 's and greater currents than the unblasted CRS in *Figure 29*. In addition, none of the panels passivate in the borate/chloride buffer.

Hot Rolled Steel

One of the important differences between hot rolled steel and cold rolled steel is that HRS contains mill scale (high temperature oxidation products formed during the rolling process), which is cathodic to the rest of the steel. The difference in potential generated between steel and mill scale can often amount to 0.2 to 0.3 volts. This galvanic couple is nearly as powerful a generator of corrosion currents as the copper-steel couple.¹³ Thus, we were interested to see what HRS would look like using our electrochemical profiling techniques.

UNTREATED HRS: *Figure 31* contains five scans for HRS panels from the same lot of steel. The panels show a great deal of variability, presumably due to the presence of mill scale. Several panels have E_{CORR} 's nearly 400 mv below panels from the same lot. In addition, several potential-current curves have unusual shapes indicating some sort of passivation or complex formation on the metal surface.

SANDBLASTED HRS: Data from five panels of sandblasted HRS (near white blast) can be seen in *Figure 32*. Sandblasting to a near white blast should remove all the mill scale; the E_{CORR} 's now range from -0.240 volts to -0.270 volts—a nearly ten-fold decrease in variability from the unblasted panels (*Figure 31*).

In comparing *Figure 32* with *Figure 30*, (sandblasted CRS), we can see that the two systems look very similar. Thus, electrochemically, there is little difference between sandblasted HRS and CRS.

CONCLUSIONS

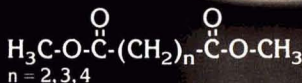
As the last substance to go over a metal substrate, the coating is often blamed when a corrosion failure occurs. While investigators in the coatings industry have intuitively suspected the existence of "good" and "bad" steel, we can now quantify that difference as well as gradations in between. The use of an electrochemical profile also allows us to map acceptable ranges of steel quality for which a coating is designed to compensate. In addition, the electrochemical tests developed are relatively rapid and should find utility as a quality control technique.

References

- (1) Hospadaruk, V., et al., "Paint Failure, Steel Surface Quality and Accelerated Corrosion Testing," Paper 780186, National SAE Meeting, Detroit, March 1978.
- (2) Buser, K.R., "The Energetics of Clean Surfaces," SME Technical Paper FC 78-574.
- (3) Wojtkowiak, J.J. and Bender, H.S., *JOURNAL OF COATINGS TECHNOLOGY*, 50, No. 642 (1978).
- (4) Iezzi, R.A. and Leidheiser, H., "Surface Characteristics of CRS as They Affect Paint Performance," *Corrosion*, 37, No. 1, 28-38 (1981).
- (5) Leidheiser, H., "Influence of Variations in the Surface Properties of Steel on the Corrosion Resistance of Body Panels," SAE Paper #134-A. (1960).
- (6) Larson, D.T., "Surface Analytic Techniques in Corrosion Science," *Corrosion Science*, 19, 657-673 (1979).
- (7) Baboian, R., "Electrochemical Techniques for Corrosion," National Association of Corrosion Engineers, Houston, TX, 1977, p 18-26.
- (8) *Ibid*, p 52-60.
- (9) Brasher, D.M., "Stability of the Oxide Film on Metals in Relation to Inhibition of Corrosion, Part II Anions," *Brit. Corr. J.*, 5, No. 122 (1969).
- (10) Morris, P.E., "New Electrochemical Techniques for High Temperature Aqueous Environments," paper presented at NACE/Corrosion Symposium, March 1976.
- (11) Wenz, R.P. and Claus, J.J., "Influence of Abrasive Cleaning on the Corrosion Behavior of Phosphate Coated Steel," *Materials Performance*, 20, No. 12, 9-14 (1981).
- (12) Ross, T.K., *Brit. Chem. Engr.*, 3, 368-370, July 1958.
- (13) Speller, F.N., "Simplified Theory on Corrosion, Steel Structures Painting Manual," Vol. 1, *Good Painting Practice*, SSPC, 4400 Fifth Ave., Pittsburgh, PA.

Reformulate with DuPont DBE, the safe, low-cost solvent

Call 800-527-2601 to get help in reformulating
your paints and coatings with DBE blends.



Changing your coating recipe? Looking for a formulation with better properties? Call DuPont first! We'll show you how to reformulate with solvent blends of DBE, DuPont's safe, low-cost solvent for industrial paints and coatings.

A colorless dibasic ester with agreeable odor and low toxicity, DBE offers a wide solvency range that makes it suitable for epoxy, polyester, polyurethane and acrylic resins and for vinyl dispersions.

And DBE excels in heat-dried coatings. In fact, solvent blends with DBE are today replacing glycol ethers in coil

and can coatings and automobile finishes.

Many successful solvent applications.

Industry has found many other successful uses for DBE solvent, including printing inks, textile lubricants, magnetic memory disc coatings, cleaning solvents, and urethane reaction solvents.

Call your DBE distributor or DuPont, today.

You can start on the way to safe, economical solvent formulations by contacting your local Chemcentral,

Houghton, Inland Leidy, or Gage distributor—or for technical information, call DuPont, toll free, at 800-527-2601.



Resin Structure And the Corrosion Resistance Of Organic Coatings Epoxy-Alkanolamine Resins

Joseph W. Holubka and Ray A. Dickie
Ford Motor Company*

Coatings with exceptional resistance to corrosion induced adhesion loss have been obtained from formulations based on epoxy alkanolamine resins and aminoplast crosslinkers. Spray primers with excellent corrosion resistance have been formulated from epoxy alkanolamine resins without the use of inhibitive pigments. The epoxy alkanolamine resins are reaction products of alkanolamines with Bisphenol A-epichlorohydrin epoxy resins; the aminoplast crosslinkers are conventional melamine-formaldehyde and urea-formaldehyde condensation products. Effects of resin structure on coating performance in accelerated corrosion and humidity testing, and on shelf life of formulated primers, are examined in detail. Best results are obtained with epoxy alkanolamine resins prepared from high molecular weight Bisphenol A-epichlorohydrin epoxy resins and a chemically equivalent amount (based on epoxide functionality) of secondary alkanolamine. Control experiments suggest that the excellent corrosion resistance of coatings formulated with epoxy-alkanolamine resins results from the resistance of the polymer to degradation by corrosion generated hydroxide, rather than from differences in transport properties or from the presence of amine or other specific functionality in the resin.

INTRODUCTION

One of the major causes of paint adhesion failure in the early stages of the corrosion of painted steel is disruption of the paint/metal interface by corrosion generated hydroxide.¹⁻⁶ The rate of corrosion induced adhesion failure is apparently related to the ease of hydrolysis of linkages within the polymer network,⁷⁻⁹ among other variables. Coatings that are resistant to moisture induced

adhesion loss and that comprise few saponifiable moieties tend to retard the lateral spread of corrosion.^{7,9}

In this paper, the synthesis and characterization of saponification-resistant resins based on epoxy alkanolamine adducts are described. Coating formulations based on these resins in combination with conventional aminoplast crosslinking agent have been prepared. Resin structure and coating formulations have been systematically varied to assess effects of these variables on corrosion resistance.

EXPERIMENTAL

Materials

All resins, reagents, and solvents were used without further purification. The epoxy resins, Epon® 828, Epon 1001, Epon 1004, and Epon 1007, referred to in this paper as Epoxy A, Epoxy B, Epoxy C, and Epoxy D, respectively, were obtained from the Shell Chemical Co.; the cycloaliphatic epoxy resin Cy179®, referred to in this paper as Epoxy E, was obtained from CIBA-GEIGY Corp. The alkanolamines, ethanolamine, 3-amino-1-propanol, 2-(2-amino-ethylamino)ethanol, 2-(methylamino)ethanol, and diethanolamine were purchased from Aldrich Chemical Co. The crosslinking agents RN602 and RN519, polymeric, butylated melamine and urea resins, respectively, were obtained from Mobil Chemical Co. Cymel® 301, a monomeric, methylated melamine and Cymel 1141, a polymeric, carboxy-modified melamine were obtained from American Cyanamid Co. LTX® 127, a polymeric, methylated melamine, was obtained from Monsanto.

Preparation of Epoxy Alkanolamine Resins

The preparation of the epoxy alkanolamine resins typically involved the slow addition of the epoxy resin to a solution of an equivalent amount of the alkanolamine in

*Research Staff, Box 2053, Dearborn, MI 48121.

methyl amyl ketone maintained at 60–80°C. After the initial reaction, heating was continued for about four hours to insure complete reaction. A polar solvent (e.g., butanol) was added at the end of the reaction to maintain a homogeneous solution and reduce the viscosity. In general, the concentration of the epoxy alkanolamine resin solution was maintained in the range of 45–60 weight percent. The concentration of the resin solution was limited by the viscosity of the adduct solution and, hence, by the molecular weight of the epoxy resin used in preparing the adduct.

Primer Formulation

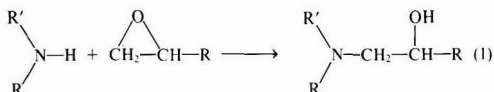
Primers were formulated using conventional techniques. For pigment dispersion, 399g of the epoxy alkanolamine resin solution (at 46% solids) was combined with 45.9g RN602, and 6.7g RN512 in a 1.6:1 xylene:butanol solvent. A mill base was prepared by dispersing one third of this resin solution with pigments (10.9g silica, 15.0g titanium dioxide, 15.0g Neotex 130 carbon black and 101.5g barytes) using metal shot. The remaining resin solution was then combined with the mill base and dispersed. The filtered primer had a Hegman gauge reading of 7 and a weight percent solids of 49%. Primers were applied to test panels by conventional air atomized spray and cured in an air circulating oven for 20 minutes at 180°C.

Test Procedures

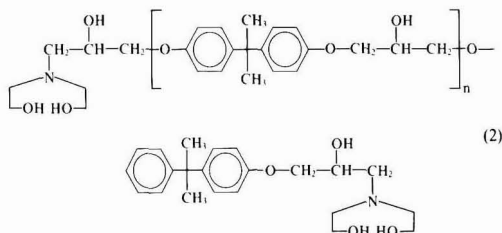
Test primer samples were applied to cold rolled, unpolished steel panels. Salt spray tests of 24 and 240 hour duration were conducted according to ASTM test method B117 using a Singleton SCCH Corrosion Test Cabinet. Condensing humidity tests (ASTM D2246 and D2247) were conducted using a Cleveland Humidity Cabinet (Q-Panel Co.), at 60°C water temperature. The cathodic polarization experiment described previously¹ was used to evaluate the resistance of the epoxy alkanolamine based primers to corrosion-generated hydroxide.

RESULTS AND DISCUSSION

The well known condensation reactions of aromatic and aliphatic amines with diepoxides result in the formation of epoxy amine adducts. The first step of this reaction involves the opening of the oxirane ring in a process that is catalyzed by alcohols:¹⁰



In the present work, the reactions of secondary alkanol amines (e.g., diethanol amine) with any of a variety of Bisphenol A epichlorohydrin epoxy resins affords stable epoxy alkanol amine adducts:



The preparation of these epoxy alkanol amine resins involves the addition of amine to epoxy without polymerization. The molecular weight of the resin is thus governed by the molecular weights of the epoxy resin and the secondary alkanol amine.

The secondary alkanol amine used in preparing the epoxy alkanol amine resin was found to strongly influence the stability of the resins. Resins prepared from epoxy resins and secondary alkanol amines were typically stable. No appreciable change in viscosity was noted for these resins even after prolonged storage (up to one year) at room temperature. In contrast, epoxy alkanol amine resins prepared using primary alkanol amine resins had shelf-lives of less than one day. The instability of these resins has been attributed to uncontrolled polymerization and network formation (primary amines react with diepoxides to afford partially crosslinked high molecular weight polymers).

Curing of the Epoxy Alkanol Amine Resins

The condensation of epoxy resins with alkanol amines generates resins that have hydroxy groups pendant to a generally hydrophobic backbone. The resins may be crosslinked using aminoplast resins to generate highly alkali resistant ether linkages. The reactions of aminoplast resins with hydroxy containing polymers are pH controlled and are generally acid catalyzed. Well cured (highly solvent resistant and moisture resistant) coatings have been obtained from formulations incorporating the epoxy C-diethanol amine resin and a conventional butylated melamine resin after baking at 180°C for 30 minutes. Coatings baked at temperatures less than 180°C were not satisfactorily cured and had poor solvent and moisture resistance. The bake temperature required to crosslink the epoxy amine resin with the melamine crosslinker was about 40°C higher than that which is normally required to cure a typical hydroxy functional polymer such as an acrylic resin. The high cure temperature required presumably reflects inhibition of the normally acid catalyzed melamine crosslinking reaction by the basic epoxy amine resin.

For coatings formulated with epoxy-primary alkanol amine resins, the cure chemistry was found to be more complex. In these formulations the epoxy and the amine were not reacted prior to formulation of the coating composition but rather were combined with the melamine crosslinker just prior to application to a steel substrate. The principal cure reactions for this system were studied

using infrared spectroscopy. The results show that both the amine-epoxy chain extension reaction and the melamine crosslinking reaction occur simultaneously during cure. The infrared data show a decrease in the hydroxy absorption at 3600 cm^{-1} , consistent with the melamine crosslinking reaction and a decrease in the epoxy absorption at 910 cm^{-1} consistent with epoxy amine adduct formation.

EFFECT OF RESIN STRUCTURE ON CORROSION TEST RESULTS

Table 1 shows the effect of variation in epoxy amine resin structure on the resistance to adhesion loss (resistance to corrosion generated alkali) of epoxy-amine based coating formulations in cathodic polarization and salt spray tests. Variations in Bisphenol A epichlorohydrin epoxy resin molecular weight had little effect on the corrosion resistance of the formulations. Variations in alkanolamine also had little effect on corrosion resistance. Excellent alkali resistance was observed with both primary and secondary alkanolamines; although, as discussed previously, coatings incorporating primary alkanolamines had very short shelf lives.

Epoxy resin molecular weight did, however, greatly influence the humidity resistance of the epoxy-amine based formulations. Increasing the epoxy molecular weight resulted in substantial improvements in the humidity resistance of epoxy alkanol amine based formulations (Table 1). Epoxy D was the lowest molecular weight epoxy resin that afforded humidity resistant coatings when crosslinked with only a melamine crosslinker. Coatings with excellent humidity resistance could be prepared from lower molecular weight resins by using a mixture of urea-formaldehyde and melamine-formaldehyde crosslinking resins. An Epoxy C-diethanol amine resin crosslinked with a 1:4 urea-formaldehyde:

melamine-formaldehyde crosslinker mixture afforded coatings with excellent humidity resistance. Larger amounts of the urea crosslinker were found to be incompatible with the epoxy amine resin.

The type of alkanol amine used in formulating the epoxy-alkanol amine based primer also influenced the humidity resistance of the coating. In general, superior humidity resistance was obtained with secondary alkanolamines (e.g., diethanol amine). The humidity resistance of coating formulations prepared with primary amines varied as a function of storage time of the coating formulation prior to application and bake. Superior humidity performance was observed when the coating formulation was used from 30–60 minutes after preparation. Coatings obtained from the primary alkanolamine based formulations aged less than 30 minutes or more than 60 minutes showed inferior humidity resistance. The reasons for the time dependence are not fully understood, but it appears that the humidity resistance depends on the degree of condensation (molecular weight) of the epoxy amine adduct at the time of aminoplast crosslinking reaction.

The significant improvement in corrosion resistance for the epoxy amine coatings in these tests relative to, for example, conventional epoxy ester coatings can be rationalized in several ways. First, the absence of easily hydrolyzable functionality in the network may prevent or significantly limit polymer degradation by corrosion generated hydroxide. Polymer degradation of this type has been shown to be a significant factor in the disruption of coating adhesion during corrosion.^{4,6-9} Secondly, the presence of some specific interaction, e.g., between the amine functionality of the resin and the surface, could improve the resistance of the coating to displacement by hydroxide. Third, the transport properties of the epoxy amine coatings could be significantly different than those of epoxy ester coatings; the improved performance of this coating relative to conventional epoxy ester coatings

Table 1—Effect of Epoxy Amine Resin Structure On Adhesion Loss During Corrosion Testing

Epoxy Resin	Alkanolamine	Adhesion Loss (mm)			
		Salt Spray		Cathodic Polarization	Humidity (240 hr)
		24 hr	240 hr		
Epoxy A	Ethanol amine	0	0 ^a	0	—
Epoxy A	2-(Methylamino) ethanol	0	na ^b	0	Softens in 10 hr
Epoxy A	Diethanol amine	0	na ^b	0	Softens in 10 hr
Epoxy B	Diethanol amine	0	0	0	Blushes and Softens
Epoxy B	2-(Methylamino) ethanol	0	0	0	—
Epoxy C	Diethanol amine	0	0	0	Slight Blush
Epoxy D	Diethanol amine	0	0	0	No humidity sensitivity
Epoxy E	Diethanol amine	>10	>10	>10	—
Epoxy Ester	—	4-6	>10	4-6	No humidity sensitivity

(a) Results represent optimum aging of formulation (30-60 mins).

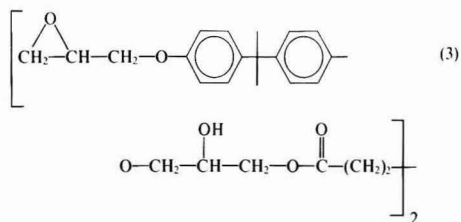
(b) Severe humidity sensitivity prevented accurate assessment of salt spray resistance.

Table 2—Corrosion Resistance of Adipic Acid Extended Epoxy-Alkanolamine Based Coatings

Epoxy	Alkanolamine	Adhesion Loss 24 hr Salt Spray (mm)
Epoxy A	Diethanol amine	2-3
Epoxy B	Diethanol amine	1-2
Epoxy C	Diethanol amine	1
Epoxy D	Diethanol amine	<1

could result from a significant reduction in transport of, e.g., electrolyte or oxygen. Two experiments were designed to test these points.

First, a series of aromatic epoxy amine resins was prepared that incorporated ester functionality in the backbone of the polymer. These ester containing epoxy amine resins were the reaction products of diethanolamine with the condensation product of a Bisphenol A epichlorohydrin epoxy resin with adipic acid:



These materials, structurally very similar to the epoxy-alkanolamine resins, were found to experience the significant adhesion loss during corrosion testing that was characteristic of other ester containing systems. The resistance to adhesion loss increased as the molecular weight of the epoxy was increased, reflecting the smaller amount of network disruption possible in the higher molecular weight resins upon hydrolysis of the ester functionality (Table 2). The results suggest that the absence of ester functionality is one of the critical factors responsible for the adhesion performance of the epoxy-amine coatings. The presence of amines and other functionality characteristic of these resins, while beneficial in imparting resistance to humidity induced adhesion loss (see, e.g., reference 11), is not sufficient to ensure resistance to adhesion loss during corrosion.

In a second experiment, the role of transport properties of epoxy amine based coatings in controlling corrosion induced adhesion loss was evaluated by preparing two-layer films that comprised both an (alkali-sensitive) epoxy-ester based coating and an (alkali-resistant) epoxy-amine coating (Table 3). In the experiment, one two-layer film was formed by coating an epoxy-ester coated steel substrate with the epoxy-alkanolamine formulation; the

Table 3—Salt Spray Test Results on Two Layer Films

First Layer	Second Layer	Adhesion Loss 24 hr Salt Spray (mm)
Epoxy Ester	Epoxy Alkanolamine	3-4
Epoxy	Epoxy Ester	0
Alkanolamine		
Epoxy Ester	Epoxy Ester	3-4
Epoxy	Epoxy Alkanolamine	0
Alkanolamine		

second two-layer film was prepared by coating an epoxy-amine coated steel substrate with an epoxy ester coating formulation. The two two-layer films thus obtained had the same overall thickness and polymer composition; the only difference was the identity of the coating system present at the metal-coating interface. The corrosion test results for these films are given in Table 3, along with results on two control films of comparable thickness, one comprising two layers of epoxy-ester, the other, two layers of epoxy-amine. The two layer film in which the epoxy ester formulation was at the steel-coating interface experienced adhesion loss from the scribe that was essentially identical to that obtained from the control sample of the epoxy ester coating (Table 3). In contrast, the two layer film prepared with the epoxy-amine formulation next to the steel coating interface experienced no adhesion loss in corrosion tests. These results strongly suggest that transport property differences across the epoxy-amine and epoxy-ester coatings cannot account for the observed differences in performance. The excellent adhesion of the epoxy-amine based coatings during corrosion is attributed to the resistance of the resin at the metal-coating interface to degradation by corrosion generated hydroxide.

References

- (1) Wiggle, R.R., Smith, A.G., and Petrocelli, J.V., *JOURNAL OF PAINT TECHNOLOGY*, 40, No. 519, 179 (1968).
- (2) Leidheiser, H. and Kendig, M.W., *Corrosion-NACE*, 32, 69 (1976).
- (3) Smith, A.G. and Dickie, R.A., *Ind. Eng. Chem., Prod. Res. Dev.*, 17, 50 (1978).
- (4) Hammond, J.S., Holubka, J.W., and Dickie, R.A., *JOURNAL OF COATINGS TECHNOLOGY*, 51, No. 655, 45 (1979).
- (5) Leidheiser, H., *Corrosion-NACE*, 38, No. 7, 374 (1982).
- (6) Dickie, R.A., in "Adhesion Aspects of Polymeric Coatings," K.L. Mittal, Ed., Plenum, New York, 1983, p 319.
- (7) Holubka, J.W., Hammond, J.S., DeVries, J.E., and Dickie, R.A., *JOURNAL OF COATINGS TECHNOLOGY*, 52, No. 670, 63 (1981).
- (8) Dickie, R.A., Hammond, J.S., and Holubka, J.W., *Ind. Eng. Chem., Prod. Res. Dev.*, 20, 339 (1981).
- (9) Hammond, J.S., Holubka, J.W., DeVries, J.E., and Dickie, R.A., *Corrosion Sci.*, 21, 239 (1981).
- (10) May, C.A. and Tanaka, Y., "Epoxy Resins: Chemistry and Technology," Marcel Dekker, Inc., New York, 1973.
- (11) Holubka, J.W., DeVries, J.E., and Dickie, R.A., *Ind. Eng. Chem., Prod. Res. Dev.*, 23, 63 (1984).



MAYBE YOU'LL WANT TO BUY LESS OF OUR NEW SiLCRON® G-131.

Now you can use less flattening agent — and save money — with SiLCRON G-131, a new synthetic fine particle silica flattening agent that provides up to 15% better flattening efficiency than our previous grade.

You'll save every time you add SiLCRON G-131 to clear and pigmented lacquer for furniture, panelling, or preformed metal, as well as aerosol lacquers, lacquer flattening bases, and

topcoats for vinyl and other coated fabrics. Its flattening efficiency in these areas can't be topped by competitive agents.

SiLCRON G-131 disperses easily with very good resistance to overgrind. It has excellent clarity in films, and its stable viscosity provides better gloss control and a smooth, uniform appearance.

And SiLCRON G-131 keeps on saving you money by extending

the useful life of products thanks to excellent suspension properties for easier reincorporation.

For more information about our new SiLCRON G-131, or for a free sample, fill out the coupon or call our toll-free customer service hot-line: 800-638-3234. And see how much you can save on flattening costs this year.

SCM® **PIGMENTS**
SCM CORPORATION
BALTIMORE, MARYLAND 21230

SCM Pigments, SCM Corporation
2700 Hollins Ferry Road
Baltimore, MD 21230
Attention: R. L. Green

- Send me information about SiLCRON G-131.
 Send me a free sample of SiLCRON G-131.

Application _____

Name _____

Title _____

Company _____

Address _____

City _____

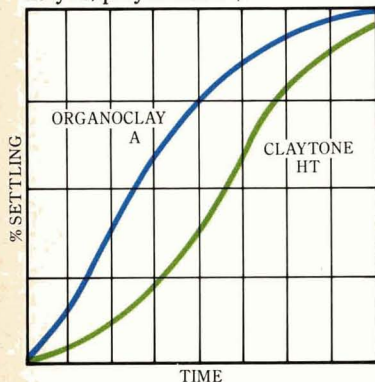
State _____

Zip _____

Thixotropic control: a constant battle against time.

Time. It's the biggest challenge thixotropic control faces. Often, the difference between poor and great thixotropic control becomes increasingly evident as time passes by. But now there's no excuse for poor thixotropy — not even time — because Southern Clay Products has developed highly thixotropic CLAYTONE HT. CLAYTONE HT gives coating systems superior suspension properties and excellent sag control — even after months on the shelf.

CLAYTONE HT promotes high shear fluidity while providing excellent sedimentation control. That makes CLAYTONE HT especially useful in two-component and aerosol applications. CLAYTONE HT is fully compatible in wide ranging solvent systems of varying polarity, including most aliphatic and aromatic hydrocarbons, esters, polyethers, ketones, alcohols, vinyl acrylics, natural oil alkyds and two-component enamels (epoxy/polyester, polyester/polyurethane, or acrylic/polyurethane).



With CLAYTONE HT, Southern Clay Products takes the guesswork out of rheological control by



Southern Clay Products

ensuring that each and every batch produces consistent viscosity levels. And CLAYTONE HT is designed to save you money. Often, a lesser amount of CLAYTONE HT will produce the same results as a larger amount of a competitive product.

Next time you find yourself battling with thixotropic control, try CLAYTONE HT.

For additional information, call or write. Southern Clay Products, P.O. Box 44, Gonzales, Texas 78629, Tel. (512) 672-2891

Effect of Zinc Oxidation on the Conductivity And Performance of Di-Iron Phosphide Augmented Zinc-Rich Primers

Newton C. Fawcett,* Craig E. Stearns,[†] and B. George Bufkin**
University of Southern Mississippi

Five pigment-grade zinc dusts are analyzed and found to vary in oxide content from 4 to 44%. Zinc dust that is initially low in oxide is artificially aged to create a range of dusts with increasing oxide content. These dusts are used to explore the effect of zinc oxidation on the anti-corrosion performance of a primer co-pigmented with zinc and di-iron phosphide. It was found that for a primer pigmented with an equal weight of zinc and di-iron phosphide the optimum ZnO content of the zinc portion of the pigment lies between 18 and 27%. Primer performance in salt fog and humidity testing, and primer conductivity are reported as functions of degree of zinc oxidation. The results are found to be consistent with the previously proposed mechanism for di-iron phosphide function in zinc primers.

INTRODUCTION

Zinc dusts necessarily contain surface oxide as a mostly adherent coating on the zinc particles. The literature is unclear on what oxide content is suitable for zinc used in zinc-rich primers. Mayne and Evans¹ and Pass² have suggested the use of zinc containing as little oxide as possible, whereas, Floyd and Glaser³ have provided data showing that appreciable levels of oxide can be tolerated and are perhaps beneficial.

In studying factors which affect the anti-corrosion performance of epoxy-ester bound, zinc-pigmented primers augmented with di-iron phosphide*; it was found that commercial zinc dusts from five different suppliers varied in free zinc content from 56 to 96%, implying oxide content from 4 to 44%. In view of this wide range of oxide

from one source of zinc to another, experiments were undertaken to determine the effect of zinc surface oxidation on primer conductivity and anti-corrosion performance.

This paper reports the results of analyzing five commercial, pigment grade, zinc dusts for free zinc, and the effect of various degrees of zinc oxidation on the performance in salt fog and humidity of an epoxy-ester bound primer co-pigmented with zinc and di-iron phosphide. Also reported is the relationship between film conductivity and oxide content.

EXPERIMENTAL

Zinc Analysis

Zinc was analyzed by its reaction with eight molar sulfuric acid to produce one mole of hydrogen for each mole of free zinc reacted. The hydrogen produced was collected over water using a calibrated, glass gas-collection apparatus. The volume of gas collected was corrected for barometric pressure, temperature, and the vapor pressure of water. In all cases the percent of zinc oxide was obtained by the difference between the free zinc expected based on sample weight and the amount found by experiment.

Preparation of Zinc Dusts With Different Oxide Content

St. Joe® #560 zinc dust obtained from the St. Joe Zinc Co. assayed at $96.8 \pm 0.34\%$ zinc as received. This was artificially aged in a shallow enameled pan by exposure to air at 145°C and 100% humidity. The dust was stirred several times each day and at approximately 10 day intervals samples were taken and analyzed for free zinc. In this way three zinc dusts (Z2, Z3, and Z4 in Table 1) of

*Dept of Chemistry, USM, Southern Station, Box 5043, Hattiesburg, MS 39406

[†]Present address is The Sherwin-Williams Co., 1370 Ontario St., Cleveland, OH 44113.

**Dept. of Polymer Science, USM, Southern Station, Box 5043, Hattiesburg, MS 39406.

^{††}Di-iron phosphide is sold under the tradename Ferrophos by the Occidental Chemical Corp., Niagara Falls, NY.

Table 1—Metallic Zinc Content of Partially Oxidized Zinc Dusts Prepared from a Single Parent Dust.

Dust#	Oxidation Time (hr)	% Zinc ^b
Z1 ^a	0	96.8 ± 0.34
Z2	400	82.3 ± 1.2
Z3	600	72.7 ± 0.82
Z4	1000	55.5 ± 0.91

(a) Dust Z1 was #560 zinc supplied by the St. Joe Zinc Co., Monaca, PA. Z1 was oxidized to produce Z2, Z3, and Z4.

(b) Percentages are shown ± sample standard deviation of the mean; n = 3.

increasing oxide content were prepared from the parent St. Joe zinc.

Primer Formulation

The primer formula used is given in Table 2. This is a development formula that is not necessarily optimum, but has proven to give uniform results and good corrosion protection. Four primers were prepared, one from each of the four zinc dusts listed in Table 1. The pigment of each primer was a 50/50 equal weight mixture of di-iron phosphide and zinc dust. All primers were approximately 30% underbound based on the oil demands of the di-iron phosphide and the zinc dust.

Test Panel Preparation

Test panels measured 3X6 in. and were made of mild, cold-rolled steel. After a xylene wash the panels were hand sprayed on both sides with primer that had been let down with xylene to give a 15 second stream time with a No. 4 Ford cup. The coatings were cured for one week at room temperature. Nominal film thickness was 2 mils with Elcometer readings of 2.1 through 2.6 mils for panels used in salt fog tests and 2.1 through 2.3 mils for those used in humidity tests.

Film Resistance

DC electrical resistance of the primer films was determined by spraying each primer in duplicate on glass

Table 2—Fe₂P-Zn Primer Formula

Component	Supplier ^a	Parts by wt.
RCI 38-407 epoxy-ester resin	Reichhold	18.4
MPA-60 polyethylene anti-settling	NL Industries	8.7
Aerosil R972 fumed silica	Degussa	2.0
Calcium oxide dessicant	Baker	1.0
HRS-2131 di-iron phosphide	Occidental	74.8
Zinc dust	St. Joe	74.8
Co & Mn driers	Tenneco	<1.0
Ketoxime anti-skin	Troy	<1.0

(a) Suppliers: Reichhold Chemicals, Inc., White Plains, NY; NL Industries, Bayonne, NJ; Degussa, Inc., Teterboro, NJ; J. T. Baker Chemical Co., Phillipsburg, NJ; Occidental Chemical Corp., Grand Island, NY; St. Joe Zinc Co., Monaca, PA; Tenneco Chemicals, Inc., Elizabeth NJ; Troy Chemical Corp., Newark, NJ.

Table 3—Metallic Zinc Content Of Five Commercial Zinc Dusts^a

Dust ^b	% Zinc ^c
St. Joe #560	96.8 ± 0.34
Genco L350	92.5 ± 2.3
Genco L670	87.0 ± 0.7
Fed 111	79.4 ± 2.2
NJ 44	55.6 ± 1.6

(a) % Zn values shown represent the metallic zinc content on the day the analyses were performed. No representation is intended with respect to the metallic zinc content of the dusts on the date they were shipped from the supplier.

(b) Genco = GENCO, Canada; St. Joe = St. Joe Zinc Co., Monaca, PA; Fed = Federated Metals, New York, NY; NJ = New Jersey Zinc Co., NJ.

(c) Percentages are shown ± sample standard deviation of the mean; n = 3.

plates fitted with metal foil strips 1 cm wide and with a 1 cm gap in the middle of each strip. The resistance of the cured primer film was then measured by wiring each plate in series with a known resistance, imposing a small known voltage drop of approximately 200 millivolts across the circuit, and measuring the portion of the total voltage drop that appeared across the primer film. Ohm's law was then used to compute the resistance of the film.

Performance Testing

Four panels were prepared from each of the primers to be tested. The primers were tested in duplicate in both salt fog and 100% humidity. Salt fog testing was carried out according to ASTM Method B117-64 for 750 hours but with the temperature maintained at 50° C. Humidity testing was carried out using a conventional humidity cabinet at a temperature of 50°C for 1178 hours in accordance with ASTM Method D2247-68. After both humidity and salt fog testing the primer was removed from the panels and the degree of rusting on the steel substrate evaluated according to ASTM Method D 610-68 (1974). In this method a rust grade of 10 corresponds to less than 0.01% of surface rusted and a grade of 0 to 100% surface rusting. The results of these tests are shown graphically in Figures 1 and 2.

RESULTS AND DISCUSSION

Upon storage zinc dust can increase in oxide content, and the extent of increase can be expected to depend on storage conditions. Oxide content also depends to some extent on the production process and handling procedures used by the manufacturer.

The percent of metallic zinc found in five commercial dusts is shown in Table 3. These results were obtained by random sampling of roughly 100 lb quantities of each zinc. To obtain as representative a sample as possible, each dust was well mixed before sampling and then several portions of dust were removed from different locations in the container. Finally, each of the separate portions drawn from each dust were combined and thoroughly mixed, and the resulting homogenized sample was analyzed in triplicate.

The zincs in Table 3 were obtained at different times from their respective suppliers and they have slightly

different mean particle sizes. This table shows the variation in oxide content found in representative dusts after storage for an undetermined time, and therefore does not permit the drawing of any conclusion with regard to the oxide level in any particular manufacturer's product at the time of shipping.

To investigate the effect of zinc surface oxidation on the conductivity and performance of a zinc-pigmented primer, it was desirable to obtain several zinc dusts that were identical in all respects except for their degree of oxidation. Accordingly, a series of four dusts with increasing oxide content was prepared from a single parent dust. This was done by selecting a dust with low initial oxide content as the parent, and artificially aging the dust under 100% humidity at 145°C. This procedure resulted in the dusts labeled Z1 through Z4 in Table 1.

Four batches of primers were then made, each using a different zinc dust from Table 1, but otherwise identical. The formula for the primers is given in Table 2. Based on the oil demand of the parent zinc and di-iron phosphide this formulation gives a primer that is approximately 30% underbound.

A decision was made not to attempt to adjust slightly the pigment-binder ratio to allow for any differences in the oil demands of the zinc dusts, since: (1) These differences were found to be on the order of error associated with spatula rub-out determination of oil demand (This is not surprising in view of the fact that all the dusts came from the same parent and therefore would be expected to have nearly the same particle size.); and (2) It was desirable to duplicate as nearly as possible the situation and results that would pertain to production of primer with zinc of varying oxide content where the producer was either unaware of or otherwise ignored the difference.

Figure 1 shows the DC resistance in ohms measured for each of the four test primers as a function of oxide content of the zinc pigment. As expected, resistance increased with oxide content.

The resistance values in Figure 3 are in the megohm region; however, these are for resistance through 1 cm of the film, whereas in an actual application the resistance between primer film and steel substrate will be orders of magnitude less because the effective pathlength for conduction is then reduced to the thickness of the primer.

In Figures 1 and 2, the anti-corrosion performance of the test primers in salt fog and humidity are shown, respectively. These results are for duplicate cold-rolled steel panels protected with a nominal 2 mil coating of primer.

The tests were carried out to produce at least some degree of failure in all the primers so that differences would be maximized. In particular the temperature in salt fog testing was elevated to 50°C, slightly above that called for in the standard ASTM test. Under milder test conditions at greater than 2 mil film thickness it was found that properly formulated primers perform so well that it is often difficult to observe differences in the protection afforded by minor changes in composition.

The degree of rusting noted in Figures 1 and 2 was that of the steel substrate. These observations were made after mechanically removing the warm, moist coating from

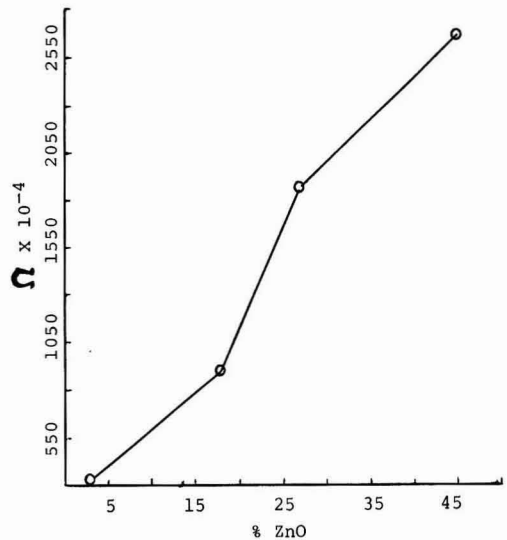


Figure 1—DC resistance of primers vs % ZnO in the zinc dust portion of the pigment

each test panel at the conclusion of the test. Although the subjective nature of the ASTM rust grade scale does not allow reliable absolute comparisons to be made, the relative performance of the primers is easily distinguishable in Figures 1 and 2. These Figures show that for the formula tested the optimum ZnO content lies between about 18 and 27% of the total weight of zinc pigment.

In previous work on primers co-pigmented with di-iron phosphide and zinc it was noted that primers pigmented with 50/50 zinc/di-iron phosphide, where the zinc contained 18% oxide, withstood salt fog exposure

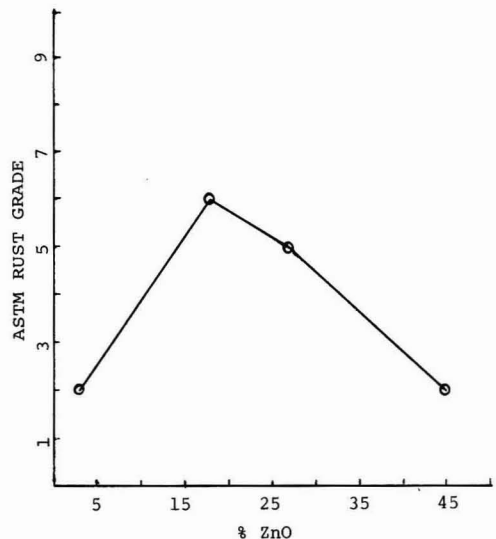


Figure 2—Substrate rusting after 750 hr salt fog exposure at 50°C vs % ZnO in the zinc dust portion of the pigment

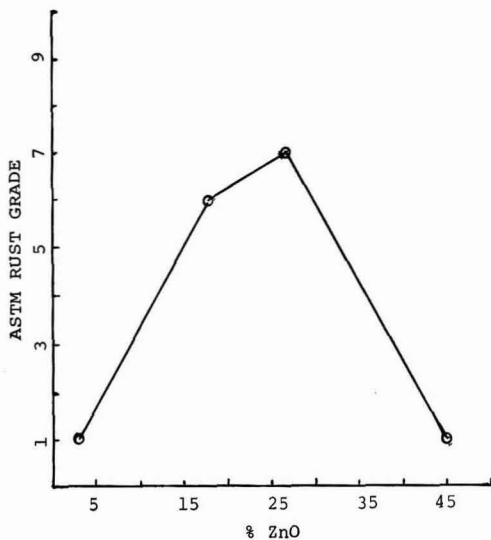


Figure 3—Substrate rusting after 2150 hr humidity exposure at 50°C vs % ZnO in the zinc dust portion of the pigment

considerably better than comparable primers pigmented with the same zinc alone.⁴ Performance at the 18% oxide point in Figure 1 is consistent with that previously obtained when allowance is made for a difference in exposure time.

It has been proposed that di-iron phosphide functions by sharing the role of cathode with the steel substrate. And in so doing it considerably expands the cathode surface area, thereby decreasing the cathodic current density. It was further suggested that the decrease in blistering observed for zinc primers co-pigmented with di-iron phosphide was a consequence of this lowered cathodic current density.⁴

In the present study, extensive blistering was noted on salt fog panels painted with the lowest oxide formulation. (The 3% ZnO point in Figure 1.) Thus, assuming the foregoing mechanism for di-iron phosphide activity, it appears that the expansion of cathode surface area by incorporation of 50% by weight di-iron phosphide is insufficient to prevent blistering in the presence of highly active, low-oxide zinc.

At the other extreme, with the highest oxide formulation, blistering did not appear important as a cause of

failure. Failure in the case of high oxide levels and correspondingly high film resistances may be due to insufficient cathodic current during the earliest stage of exposure where the cathodic protection mechanism is thought to be most important.⁴

Results of the present study suggest that a relationship should exist between the optimum zinc/di-iron-phosphide ratio and oxide content of the zinc. For example, one should not be surprised to find that still greater di-iron phosphide content gives satisfactory performance in the presence of highly active, low oxide zincs, whereas less active, higher oxide zincs may require lower proportions of di-iron phosphide.

It would appear that an optimum ratio of zinc to di-iron phosphide is that which gives the minimum total cathode area without blistering during the most active phase of cathodic protection.

SUMMARY AND CONCLUSIONS

In summary, the oxide content of zinc pigment in the primer system studied was shown to have an important effect on anti-corrosion performance.

In an epoxy-ester bound system pigmented with a 50/50 weight ratio of zinc and di-iron phosphide, the optimum oxide content for zinc was found to lie between approximately 18 and 27%.

The results obtained were consistent with the previously proposed mechanism for di-iron phosphide activity in zinc-pigmented primers.

The results clearly demonstrated the need for control of oxide levels in zincs used in commercial production of primers pigmented with zinc and di-iron phosphide.

ACKNOWLEDGMENT

The authors thank the St. Joe Zinc Co., and Reichhold Chemicals, Inc., for generous gifts of zinc and resin, respectively, and the Occidental Chemical Corp. for financial support.

References

- (1) Mayne, J.E.O., and Evans, U.R., *Chem. Ind.*, 63, 109 (1944).
- (2) Pass, A., *J. Oil Col. Chem. Assoc.*, 35, 241 (1952).
- (3) Floyd, D.E. and Glaser, D.W., *Official Digest*, 38 (Jan, 1963).
- (4) Fawcett, N.C., Stearns, C.E., and Bufkin, B.G., manuscript submitted to *JOURNAL OF COATINGS TECHNOLOGY*.

CONVENTIONAL ACRYLICS WERE GREAT IN CONVENTIONAL TIMES.

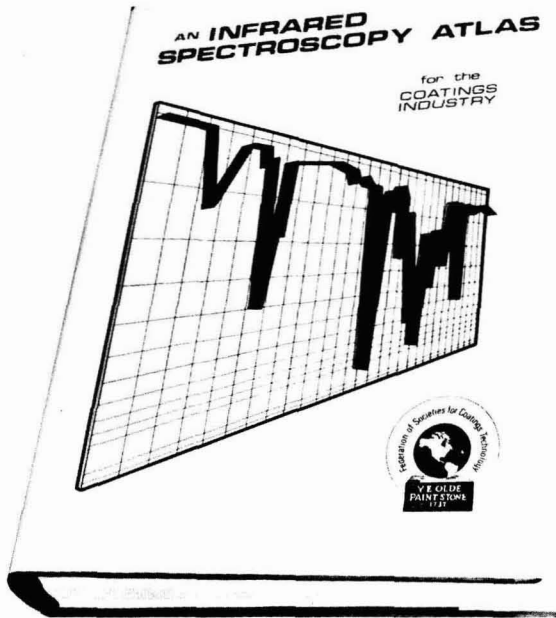
But in these times, soaring raw materials prices can add up to problems for any paint manufacturer. So ask your local Union Carbide Sales Representative about UCAR® Acrylics. And when it comes to price, find out how unconventional they are.

UCAR ACRYLICS



FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Announces the



896 Pages
Over 1,400 Spectra
Over 1,500 References

This revised and expanded 896-page book (by the Chicago Society for Coatings Technology) contains a compilation of 1433 spectra, fully indexed, of materials commonly used in the coatings industry. Spectra of many recently marketed materials are included, as well as examples of Fourier transform infrared spectra.

The text consists of nine fundamental and comprehensive chapters including theory, qualitative and quantitative analysis, instrumentation, IR instrumentation accessories, and sample preparation. A chapter concerning applications contains a comprehensive text which should be invaluable to anyone practicing infrared spectroscopy.

A fully indexed literature survey contains over 1500 references and represents the most complete bibliography published in this type of text. It is organized into sections, such as theory, reviews, instrumentation, experimental techniques, compilation of spectra, and pigment applications, and each section is in chronological order.

8½ × 11 in., case-bound. ISBN 0-934010-00-5

AN INFRARED SPECTROSCOPY ATLAS

Check one: \$75.00—Federation Member \$100.00—Non-Member

(Shipping Charges Extra)

TERMS OF ORDER

→ PLEASE MAKE ALL CHECKS PAYABLE IN U.S. FUNDS ←

PREPAID ORDER:

Add \$3.00 per copy to order to cover handling and postage.

ORDERS REQUIRING BILLING:

Add \$6.00 per copy to order to cover handling and postage.

Name _____

Company _____

Address _____

City _____ State _____ Zip Code _____

PLEASE MAKE ALL CHECKS PAYABLE IN U.S. FUNDS

Federation of Societies for Coatings Technology • 1315 Walnut Street, Philadelphia, Pa. 19107

Pennsylvania residents please add 6% sales tax

AVAILABLE IN THE U.K. FROM:

Birmingham Paint, Varnish and Lacquer Club

c/o Mr. Ray Tennant, Carrs Paints Limited, Westminster Works, Alvechurch Rd.
Birmingham B31 3PG, England

Ellipsometric Studies Of Chelating Inhibitor Effects On the Cathodic Delamination Of an Organic Coating on Iron

Joseph J. Ritter
National Bureau of Standards*

Qualitative ellipsometry has been used to study the effects of chelating inhibitors on the cathodic delamination of an acrylic coating from an iron surface. The chelating inhibitors 8-hydroxyquinoline (8-HQ) and 2,5 dimercapto 1,3,4 thiazazole (DMTDA), when dispersed in the coating were observed to delay the onset of delamination. A similar beneficial effect was noted with a two-layer system employing a zinc chromate primer. Catechol was found to be an ineffective inhibitor. Moreover, when 8-HQ and DMTDA were applied by an anodic pretreatment procedure they were relatively ineffective, whereas 4-methylcatechol similarly applied exhibited impressive inhibition.

INTRODUCTION

Previous publications from our laboratories have shown the effectiveness of qualitative ellipsometry in the study of interfacial cathodic events during the corrosion of painted metal surfaces.¹⁻⁴ Since coatings bond to the metal oxide films, and since many corrosion inhibitors seem to function at or within this interfacial metal oxide film, it seemed a natural extension of our previous work to examine the effects of corrosion inhibiting species on cathodic delamination. While many paint systems currently in service rely heavily on inorganic species to achieve inhibition, an active search goes on for substitute materials to obtain more effective inhibition, reduce costs, meet environmental standards, and minimize the consumption of strategic metals.

We selected a small group of organic molecules with a potential for forming coordination complexes with iron. The effectiveness of these types of chelating molecules in corrosion inhibition has been described previously by other investigators.⁵⁻⁶

The present work will describe the cathodic delamination behavior of acrylic coated iron where chelating inhibitors have been supplied in two different ways. In the first method, the inhibitor is homogeneously dispersed within the coating; while, in the second method, the inhibitor is applied in a two step anodization process, as recently described by Leidheiser et al.⁷ An acrylic coating is applied over this pretreated surface.

EXPERIMENTAL

Commercially procured iron specimens (99.95% Fe with respect to metallic content) were mounted in epoxy and finished on a series of SiC papers of 320, 400, and 600 grit. Final polishing was accomplished with 6.0, 1.0, and 0.05 μm abrasives. This degree of polishing was necessary to promote good specimen reflectivity and thus reasonable ellipsometric signal levels after the coatings were applied. Generally, the polished specimens were aged over silica gel for about 18 hr prior to coating.

A clear, proprietary acrylic coating material was dissolved in toluene and specimens coated by dipping. Typically a 0.010 to 0.013 cm (0.004 to 0.005 in.) thick-coating was achieved by this procedure. The chelating inhibitors employed and their structural formulae are given in *Figure 1*. Chelating inhibitors were dispersed in the coating material in the 1 to 2 percent range by first dissolving the inhibitor in toluene and then using this toluene as the solvent to prepare the coating medium. The

* Inorganic Materials Div., Center for Materials Science, Washington, D.C. 20234.

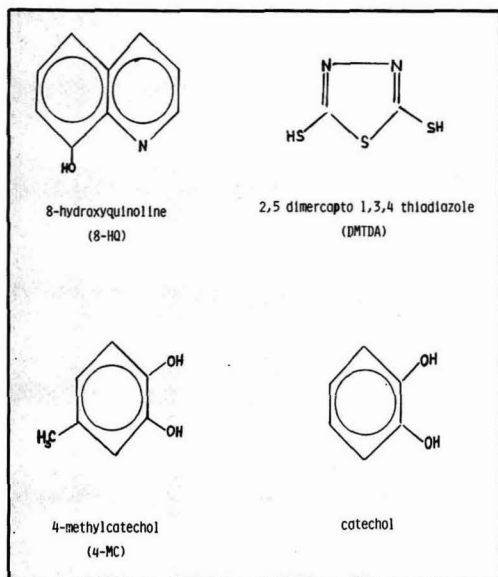


Figure 1—Structural formulae for the chelating inhibitors

two layer, nine percent zinc chromate primer* system shown in *Figure 2* was prepared by pressing a 6.0 mm dia. polytetrafluoroethylene cylinder to the center of the metal surface and applying the proprietary primer by brushing. After the primer had cured, the PTFE mask was removed, and the clear acrylic topcoat was applied by dipping. The 6.0 mm view of the metal surface through the clear acrylic provided the necessary observation "window" for the ellipsometric experiments on this specimen.

The two step anodization procedure for the applications of chelating inhibitors was adapted from the method described by Leidheiser et al.⁷ The method is summarized as follows. An uncoated, mounted iron specimen is aligned in the ellipsometer cell and submerged in 170 mL pH 8.4 borate buffer solution. The solution is deaerated with N_2 and the specimen is observed ellipsometrically under open circuit conditions for ~ 1.0 hr. An anodic film is grown on the metal surface with an impressed voltage of 1.2 V S.C.E. After ~ 10 min of anodization, 50 mL of borate buffer containing a quantity of chelating material calculated to give $\sim 10^{-4}$ M chelate concentration in the total solution is added. Rapid mixing is effected by the continuing N_2 flow, and the potential is held at 1.2 V S.C.E. until the inhibitor layer is well developed. The layered structure is shown schematically in *Figure 3*. The specimen is removed from the cell, rinsed with water, dried with an air jet, and coated with acrylic by dipping. Typical coating cure times were 24 hr at 25°C. The acrylic lacquer, once cured, showed good adhesion to both the polished and anodized metal surfaces.

The corrosion of all coated specimens was conducted in 0.05 M NaCl at 25°C. Typically, the coated specimens

were observed for 400 to 500 min before the corrosion process was initiated by puncturing the coating ~ 0.5 cm from the ellipsometric observation region, as shown in *Figure 2*. Ellipsometric data were acquired at a rate of one set of points per minute, under computer control.

Interpretation of Ellipsometric Behavior For the Iron/Acrylic System

For comparison purposes, a typical ellipsometric response curve for acrylic coated iron undergoing corrosion in 0.05 M NaCl is shown in *Figure 4*. A detailed interpretation of this type of response has been given previously,⁴ but a brief summary is provided here. Previous observations on uncoated iron systems under potential control in either borate buffer solutions or in saturated NaOH solutions indicate qualitatively that simultaneous changes in the Δ and ψ parameters in opposite directions is indicative of a change in the metal oxide film thickness. A simultaneous change of Δ and ψ in the same direction is indicative of a surface texture change, i.e., surface roughening or smoothing. The coating on the system shown in *Figure 4* was punctured at $t = 0$. At about 500 min, the Δ signal rises while the ψ signal simultaneously declines. These changes are interpreted as a thinning of the interfacial oxide film on the basis of our ellipsometer observations on uncoated iron in a controlled environment. Cathodic regions under coatings are known to become highly alkaline.¹⁻³ In earlier work,⁴ we have shown that native oxide films on iron will dissolve (i.e., become thinner) in highly alkaline media. Since the puncture site is the focus of anodic activity, cathodic sites develop elsewhere under the coating, eventually reaching the region being observed ellipsometrically. Thus, the observed mode of delamination for the system shown in *Figure 4* is the chemical dissolution of the interfacial oxide film.

Subsequent ellipsometric changes show a roughening of the resultant nearly oxide-free iron surface brought about by an uneven dissolution of the metal in the

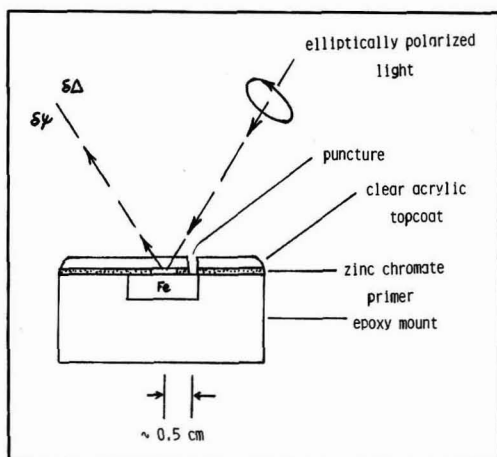


Figure 2—Cutaway view of the specimen arrangement used for the zinc chromate primer/acrylic topcoat system

*Zinc chromate primer composition: pigment 16%, titanium dioxide 91%, zinc chromate—9%; vehicle 84%, non-volatile 17%, styrene-butadiene 100%, volatile 83%, xylol 36%, aromatic hydrocarbons 64%.

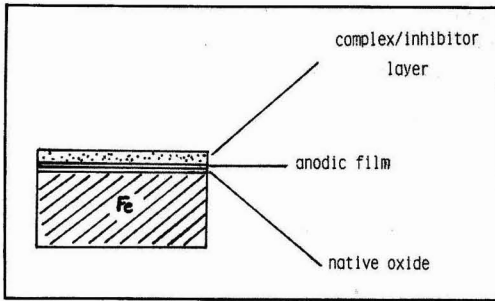


Figure 3—Proposed layered structure for specimen pretreated with an inhibitor in a two-step anodization process

alkaline environment of this interfacial region. The dissolved metal species reprecipitate, forming a new, oxide layer thicker than the original native oxide film. These events are summarized in Figure 4.

Experience gained from experiments stopped soon after surface roughening is detected ellipsometrically indicates almost invariably that the coating can be readily detached with forceps. This evidence leads us to assert that surface roughening is a post-delamination event. Thus, the ellipsometrically detected onset of surface roughening is used as a *post facto* indicator for the failure of the coating in the ellipsometrically monitored region of the specimen.

RESULTS AND DISCUSSION

Iron/Acrylic System with Coating Dispersed Inhibitors

CATECHOL: Figure 5 shows the ellipsometric responses for the iron/acrylic catechol system. The vertical (↓) in this figure and in subsequent figures marks the time at which the coating was punctured. Note that the ellipsometric activity prior to puncture suggests possible subcoating development of an inhibitor film (Δ declines, ψ rises). However, within about 100 min after puncture, surface roughening is indicated (Δ and ψ decline in concert). Obviously, catechol provides no inhibition; and, in fact, when compared to the post-puncture time scale in

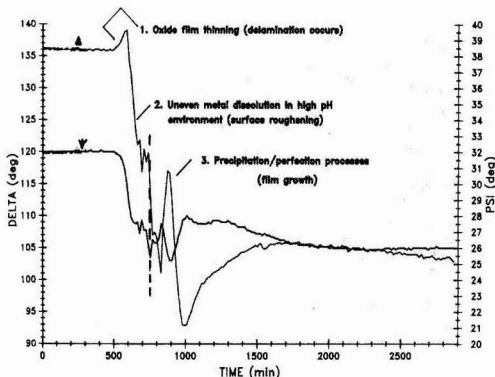


Figure 4—Typical ellipsometric response curve for an acrylic-coated iron specimen undergoing corrosion in dilute NaCl solution

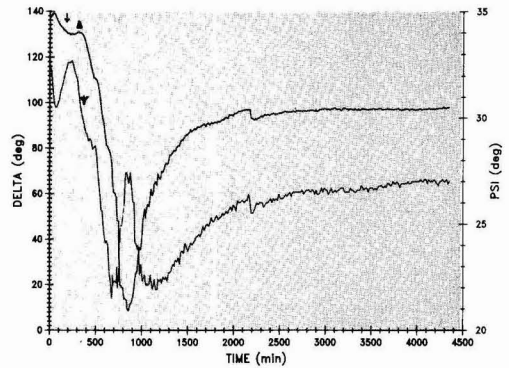


Figure 5—Ellipsometric responses for corrosion in the iron/acrylic system with 1.4% catechol dispersed in the acrylic coating

Figure 4, may actually accelerate the delamination process. This result is not surprising, since catechol reportedly offers little protection to iron systems.⁵

2,5 DIMERCAPTO- 1,3,4 THIA DIAZOLE (DMTDA): Figure 6 shows the ellipsometric responses for the iron/acrylic system with DMTDA dispersed in the coating. The pre-puncture signals suggest changes in surface texture (probably surface smoothing) as the inhibitor interacts in the interfacial region. After the coating is punctured, the onset of delamination is delayed nearly 1800 min, whereas, in the uninhibited system (Figure 4), delamination is typically seen within 500 minutes. Note also that Δ and ψ initially decline in concert, indicating that delamination has occurred just previously, and surface roughening has set in. In comparing this behavior to that seen in Figure 4, the lack of initial rise in Δ is interpreted as delamination having occurred by a mechanism other than oxide film dissolution. The presence of the inhibitor has not only delayed the onset of delamination, but has probably also altered the mode of delamination.

8-HYDROXYQUINOLINE (8-HQ): Figure 7 shows the case for inhibition by 8-hydroxyquinoline. Note there is very little pre-puncture activity but that Δ and ψ converge very slowly after the coating is damaged. This convergence is interpreted as the development of an interfacial chelate

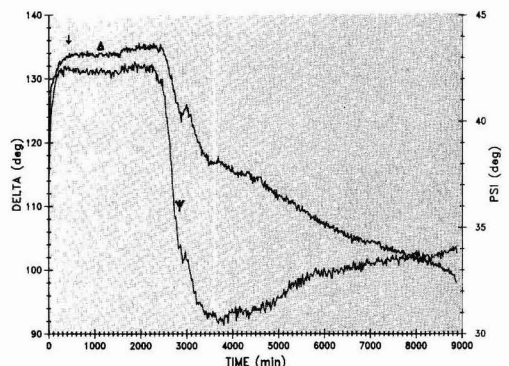


Figure 6—Ellipsometric responses for corrosion in the iron/acrylic system with DMTDA dispersed in the acrylic coating

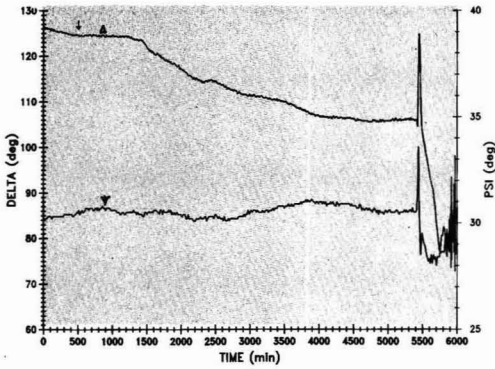


Figure 7—Ellipsometric responses for corrosion in the iron/acrylic system with 1.7% 8-hydroxyquinoline dispersed in the acrylic coating

layer. Finally, after ~ 5000 min, delamination sets in with a probable initial chemical destruction of the chelate/oxide interface, followed by the expected surface roughening phenomenon. This inhibitor delays the onset of delamination but probably does not alter the mechanism.

ZINC CHROMATE PRIMER/ACRYLIC SYSTEM: For comparison purposes, the zinc chromate primer/acrylic topcoat system was studied under comparable conditions. Figure 8 shows a decline in Δ and a very slight rise in ψ , suggesting a possible ingress of chromate into the interfacial region. Delamination is delayed by about 5000 min; a performance rather comparable to that of 8-hydroxyquinoline. Note that when the large ellipsometric changes occur, Δ and ψ move in concert, signifying the onset of surface roughening without preceding oxide dissolution; i.e., Δ and ψ do not show an initial divergence, as in Figure 4. Thus, in this system, delamination is delayed and probably occurs by some mechanism other than that of oxide dissolution.

Inhibitor Application During Anodization

Leidheiser and co-workers at Lehigh University have recently developed a two step anodization process for the application of chelating inhibitors to uncoated surfaces.⁷

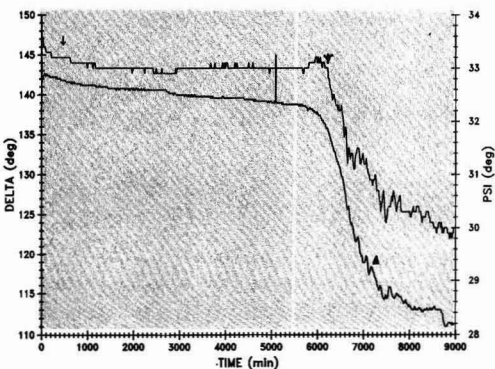


Figure 8—Ellipsometric responses for corrosion in the iron/zinc chromate primer/acrylic topcoat system

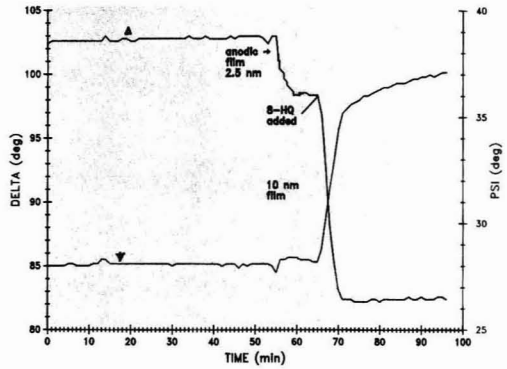


Figure 9—Typical ellipsometric responses for the application of 8-hydroxyquinoline in a two-step anodization procedure

This work has prompted us to examine this procedure ellipsometrically and also study the corrosion performance of coated samples which had been subjected to this method of inhibitor application.

Ellipsometric Changes During Two Step Anodization

Figure 9 shows, initially, the stable ellipsometric response for uncoated iron at open circuit potential in borate buffer solution. At $t \sim 50$ min, a potential of +1.2 V S.C.E. was applied to the specimen. Delta declines sharply, ψ rises slightly but measurably. These changes signify the growth of an anodic film on top of the existing native oxide film. At $t \sim 65$ min, the potential being held at +1.2 V S.C.E., 8-hydroxyquinoline was added to the solution. Delta and ψ changes indicate the growth of about 10 nm of additional film, presumably incorporating the chelating inhibitor.

Figure 10 shows the somewhat more complex behavior of DMTDA application with this procedure. The initial anodization at $t \sim 120$ min proceeds as noted earlier. However, upon the addition of DMTDA, film growth is followed by surface smoothing and then by surface roughening before a stable situation is achieved at $t \sim 150$ min. The final disposition of Δ and ψ values beyond

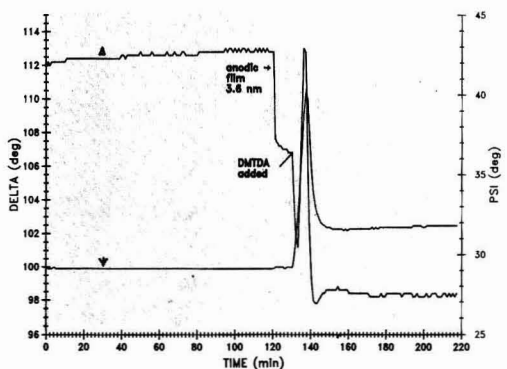


Figure 10—Typical ellipsometric responses for the application of DMTDA in a two-step anodization procedure

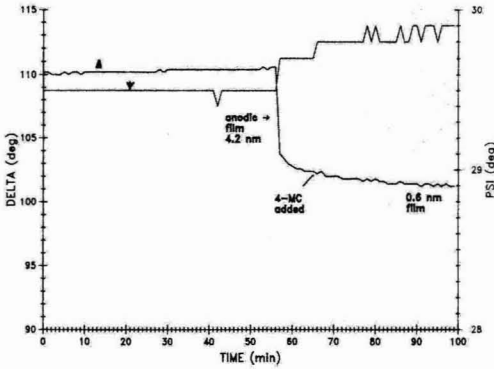


Figure 11—Typical ellipsometric responses for the application of 4-methylcatechol in a two-step anodization procedure

150 min suggest that some chelate film is probably present, although the preceding surface texture changes (i.e., the smoothing and roughening) render the estimation of its thickness difficult.

A third case of inhibitor application by two step anodization is shown in Figure 11. The early behavior of the specimen at open circuit and anodization is similar to the preceding two examples. However, the addition of 4-methyl catechol produces only a small gradual change in Δ and a very noticeable jump in ψ . These changes are interpreted to arise from the growth of a rather thin (one monolayer or less) chelate film.

Thus, in the application of different inhibitors by the two step anodization process, we have observed very diverse modes of surface modification, including the formation of thick films, surface texture changes, and the growth of thin films.

Effects of Two Step Anodization Pretreatment On the Corrosion of Coated Iron

Figures 12 and 13 show the respective performances of the acrylic coating over 8-HQ and DMTDA pretreated surfaces. In each case, delamination is seen within a few hundred minutes after the coatings are damaged, as

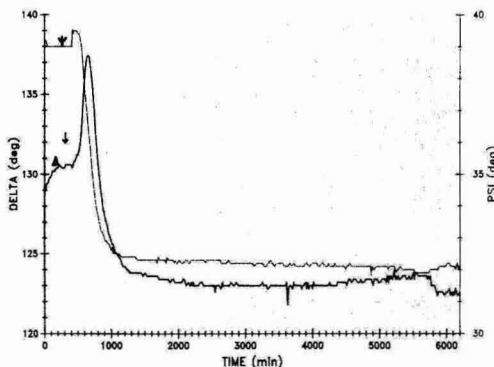


Figure 12—Ellipsometric responses for the iron/acrylic system undergoing corrosion where the iron surface had been pretreated with 8-HQ in a two-step anodization process

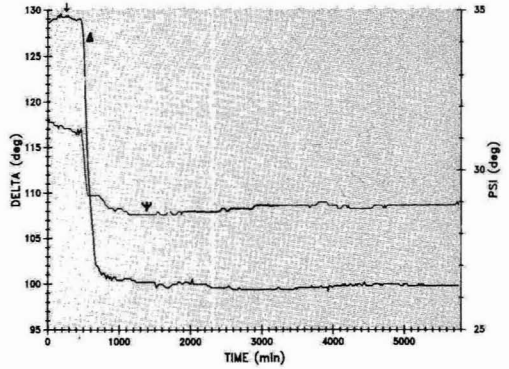


Figure 13—Ellipsometric responses for the iron/acrylic system undergoing corrosion where the iron surface had been pretreated with DMTDA in a two-step anodization process

evidenced by the early large changes in Δ and ψ . In the case of the 8-HQ treated surface (Figure 12), the delamination appears to be due to some dissolution of the anodic film, since Δ and ψ initially move in opposing directions. This detail is not seen in the case for DMTDA (Figure 13) and suggests that a different delamination mechanism may be operative. The case for the specimen anodized in the presence of 4-MC (Figure 14) is particularly interesting when compared to the other inhibitors studied. Note that, from $t=0$ to $t\sim 4800$ min, Δ and ψ show a concerted decline of only a few degrees, suggesting rather minor surface texture changes. At about 4800 min, Δ begins to increase slowly, while ψ continues to decline, suggesting a very gradual dissolution of the anodized layer and a concomitant gradual delamination. Indeed, at the termination of this experiment at 9000 min, the coating was found to be rather well adhered to the specimen surface. In contrast, the coatings on the 8-HQ and DMTDA pretreated systems could be easily detached from the substrate after only 6000 min.

SUMMARY AND CONCLUSIONS

For the iron/acrylic system studied, chelating inhibitors homogeneously dispersed in the coating affect

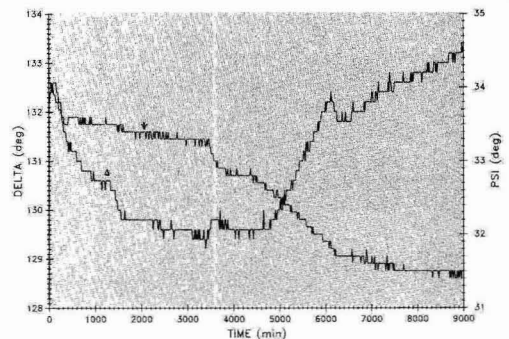


Figure 14—Ellipsometric responses for the iron/acrylic system undergoing corrosion where the iron surface had been pretreated with 4-MC in a two-step anodization process



DR. JOSEPH J. RITTER is a Research Chemist at the National Bureau of Standards. He has directed a project concerned with fundamental aspects of corrosion phenomena and chemistry which occur when painted metals corrode. Dr. Ritter holds a Ph.D. in Inorganic Chemistry from the University of Maryland.

the coating failure process by delaying the onset of delamination and/or altering the mechanism of delamination. For some of the systems studied, chemical dissolution of the oxide interface is an important mechanism for coating delamination while in other cases some alternative delamination mechanisms are operative. In all of these cases, the ellipsometrically observed roughening of the substrate, a post-delamination event, can be used as an *in situ* indicator that coating failure has occurred previously. Previous workers have proposed various other delamination mechanisms ranging from the displacement of polymer-substrate bonds by water to cohesive failure within the polymer itself.⁸⁻¹⁰ One or more of these alternate mechanisms may operate in cases where oxide dissolution is not seen or possibly may apply even in concert with oxide dissolution. This concept continues a line of argument proposed in an earlier publication⁴ that perhaps a *predominant mode* of delamination operates for a given coating-substrate system. Thus, if one mode of delamination is subverted, e.g., by inhibitor action, another mode may become predominant, albeit on a different time scale.

For the acrylic/iron system, coating-dispersed DMTDA and 8-HQ are effective in delaying coating failure, whereas catechol is not. Comparable results for inhibition have been obtained with a zinc chromate

primer/acrylic topcoat system. Our ellipsometric observations on the deposition of different chelating inhibitors during a two step anodization have shown a wide range of behaviors, including the formation of relatively thick deposits, metal dissolution, and the deposition of near-monolayer films. DMTDA and 3-HQ are not effective inhibitors for the acrylic/iron system when anodically applied, whereas good results were obtained with 4-MC.

Thus, our results indicate that, for a given coating system, both the method of chelating inhibitor introduction and its chemical nature can affect its performance in retarding coating failure.

ACKNOWLEDGMENTS

The author would like to thank Dr. J. Kruger, NBS, for encouragement and many useful suggestions. This work was partially funded by the Office of Naval Research, under contract number NAONR 18-69 NRO 36-082.

References

- (1) Ritter, J.J. and Kruger, J., *Surf. Sci.*, **96**, 364 (1980).
- (2) Ritter, J.J. and Kruger, J., "Corrosion Control by Organic Coatings," Henry Leidheiser, Jr., ed., Ntl. Assoc. Corr. Eng., Houston, TX (1981) p 28.
- (3) Ritter, J.J. and Rodriguez, M.J., *Corrosion*, **38**, 223 (1982).
- (4) Ritter, J.J., *JOURNAL OF COATINGS TECHNOLOGY*, **54**, No. 51 (1982).
- (5) Weisstuch, A., Carter, D.A., and Nathan, C.C., *Mats. Protection & Performance*, **10**, 11 (1971).
- (6) Riggs, Olen L., Jr., "Corrosion Inhibitors," C.C. Nathan, ed., Ntl. Assoc. Corr. Eng., Houston, TX (1973).
- (7) Leidheiser, H., Jr. and Konno, H., *J. Electrochem. Soc.*, (1983).
- (8) Bolger, J.C. and Michaels, A.S., "Interface Conversion for Polymer Coatings," Weiss and Cheever, Eds., Elsevier, New York, NY (1968).
- (9) Hammond, J.S., Holubka, J.W., Dickie, R.A., "Surface Analysis of Interfacial Chemistry in Corrosion-Induced Paint Adhesion Loss," *JOURNAL OF COATINGS TECHNOLOGY*, **51**, No. 655, 45 (1979).
- (10) Koehler, E.L., "Corrosion Control by Organic Coatings," Henry Leidheiser, Jr., Ed., Ntl. Assoc. Corr. Eng., Houston, TX (1981), p 87.

Minolta Announces a New Portable Color Measurement System.



Now you can measure color deviation and chromaticity with the astounding new Minolta Chroma Meter II Reflectance.

You can calibrate it to your reference standard—it offers repeatable measurement.

The Chroma Meter II Reflectance features an 8mm measuring area for precise reading of small samples. Its compact size and portability make it unique in the world of color measurement.

- Conforms to **CIE** spectral response standard
- Measurement of chromaticity: $Y_{xy}/L^*a^*b^*$
- Color deviation: $\Delta Y_{xy}/\Delta L^*a^*b^*/\Delta E$
- Reference standard can be input into memory
- Built-in stabilized Xenon light source
- Calibration can be set for illuminant condition **C** or **D65**
- Data output socket for computer interfacing

To receive full technical specifications about the fine new Minolta Chroma Meter II Reflectance, please write: Minolta Corporation
Industrial Meter Division
101 Williams Drive
Ramsey, New Jersey 07446.
Or call 201-825-4000.

CHROMA METER II REFLECTANCE



MINOLTA

ORDER FORM

PICTORIAL STANDARDS OF COATINGS DEFECTS

Revised and updated edition of this manual (previously titled "Exposure Standards Manual") has been compiled in conjunction with the American Society for Testing and Materials, and includes definition, description, and photographic standards for each of the following defects: Blistering; Chalking; Checking; Cracking; Erosion; Filiform Corrosion; Flaking; Mildew; Print; Rust; Traffic Paint Abrasion and Chipping.

Also included is reference information on supplementary standards, along with sample record sheets for compiling exposure data.

Bound in handsome 10" x 11½" x 1½" three-ring, vinyl-covered binder which readily accommodates additional material as it is developed.

Complete manual . . . \$75 (plus shipping charges)

Individual Standards . . . \$2 each, plus \$2 for each photograph.

Record Sheets (pad of 100 sheets) . . . \$2.50

Name _____

Company _____

Address _____

City _____ State _____ Zip Code _____

MAIL TO:

PLEASE MAKE ALL CHECKS PAYABLE IN U.S. FUNDS
Federation of Societies for Coatings Technology
1315 Walnut Street ■ Philadelphia, Pa. 19107
Pennsylvania residents please add 6% sales tax

Federation of Societies for Coatings Technology

Society Meetings

BALTIMORE APR.

"Formulating for Exterior Durability"

Bob Morrison, of SCM Pigments, spoke on "FORMULATING FOR EXTERIOR DURABILITY."

According to Mr. Morrison, there are four areas which contribute to formulating for exterior durability: vehicle, pigment, additives, and testing. Prior to formulating, durability parameters must be set. Mr. Morrison suggested that vehicles be selected very carefully. The vehicle protects the rest of the formula and determines the gloss, flow, and adhesion of the coatings, he said.

Using slides to demonstrate, Mr. Morrison stated that all additives put into the system must be monitored. He said that additives degrade the durability of a coating, except those which act as quasi-binders.

He stressed the importance of choosing pigments carefully. He said that titanium dioxide grade selection is critical. Even in an excellent binder, it will eventually show a plus in durability.

FRANK H. GERHARDT, *Secretary*

CLEVELAND APR.

"Water-borne System Approaches"

Honored guests in attendance included Federation President Terry F. Johnson and President of the Cleveland Paint and Coatings Association, Paul Beaudrey.

Mr. Johnson invited members to attend the Federation Annual Meeting and Paint Show in October in Chicago. He stated that this convention will have the largest number of exhibitors ever.

Mr. Beaudrey discussed the CPCA's involvement with the Cleveland Hunger Center in support of over 8000 meals provided to the needy as well as other projects. He encouraged members of the Society to consider such activities in the future.

Carol Williams, of Spencer-Kellogg, gave a presentation on "WATER-BORNE SYSTEM APPROACHES TO INDUSTRIAL MAINTENANCE COATINGS."

Ms. Williams described a solution to the problem which involves both acrylic emulsions and solvent alkyds, depending on the specific application. Storage tanks and bridges, which had been coated by this method, were depicted with little

corrosion problems. She concluded her lecture with a discussion of hardeners, such as Zn and Sr compounds.

SCOTT RICKERT, *Secretary*

GOLDEN GATE MAR.

Federation Officers Visit

Honored guests in attendance were Terry F. Johnson, Federation President, and Frank J. Borrelle, Executive Vice-President.

After thanking members who serve on Federation committees for their dedication, Mr. Johnson reminded members of the Annual Meeting and Paint Show scheduled for October.

Mr. Borrelle presented a slide show and discussed the current activities of the Federation. The topics covered included the history of and the plans for preserving "Ye Old Stone" in Boston and recommendations for dissolving the PRI. Following an introduction of Executive Committee members in attendance, Mr. Borrelle presented an update of the Federation budget. He concluded by announcing details of the new Paint and Coatings Collaboration Testing Program for lab equipment.

Robert Price, of Spencer-Kellogg, spoke on "WATER, HIGH SOLIDS, OR BOTH."

Mr. Price stated that water-thinned and high solids are both viable approaches to the increasing demand for low solvent coatings. He presented comparative performance data on short oil air dry alkyds, baking alkyds, high performance polyesters, and general purpose polyesters with water-borne, high solids, and conventional systems. General guidelines were discussed regarding the choice of one approach over another for the desired end use. He concluded by relating the importance of working with the customer to determine their needs.

SANDRA J. LUND, *Secretary*

LOS ANGELES APR.

"Dispersion"

Since this meeting was designated "Bosses' Night," President Lloyd Haanstra welcomed all the bosses in attendance.

President Haanstra congratulated Anne Probizanski and the Manufacturing Committee for their dedication and organization of the successful Manufacturing Seminar which was held on April 11.

Vagn R. Pedersen, of Tioxide Canada Inc., presented a film on "DISPERSIONS OF TITANIUM DIOXIDE."

Among the topics covered in this film were millbase formulation by a flow point curve technique, dispersion in different mills, proper high speed dispersion mill geometry, millbase stabilization, flocculation and its measurement by various methods, its effect on opacity, and the effect of UV exposure on dispersed and flocculated systems.

Mr. Pedersen also presented a film on "DISPERSION OF TiO₂ IN ALKYD RESIN." While the emphasis of this film was non-aqueous vehicles, the techniques discussed could readily be applied to other systems. The presentation was designed to be of interest to a broad spectrum of coatings technologists interested in optimizing the dispersion process and the important properties of the finished product.

HENRY J. KIRSCH, *Secretary*

NEW ENGLAND APR.

"New Methods in Coatings Rheology"

Dr. Richard Eley, of Glidden Coatings and Resins, Div. of SCM Corp., spoke on "NEW METHODS IN COATINGS RHEOLOGY."

Dr. Eley began his presentation by pointing out that all coatings must flow during one or more phases of manufacture, application, film formation, cure, or dry. Defining rheology as the science of flow, he said that it aims to relate the performance of materials to their structural or compositional features in an analytical way. However, he stated that the coatings industry historically has viewed rheology more as a quality control tool than as an instrument of research.

Dr. Eley continued his discussion by stressing the need for multipoint measurement in terms of applied shear in order to know how a coating is going to perform under given flow conditions. Since analytical expressions for stress deformation relations do not yet exist for complex systems such as coatings, it is necessary that a system be studied under

experimental conditions approximating those of actual use as closely as possible. For example, Dr. Eley said that one should not try to predict the performance of a system applied by airless spray (very high shear conditions) from an orifice cup viscosity measurement (very low shear rate experiment.) Alternatively, models can sometimes be used to extrapolate data to experimentally inaccessible conditions. He explained, therefore, that it is desirable to have in the laboratory an instrumental capability to cover the range of stresses and strain rates, as well as types of deformation, corresponding to expected use conditions.

According to Dr. Eley, the science of rheology offers a number of useful and independent measurements of flow characteristics which can help to understand and control coatings performance. These include steady-shear viscosity, dynamic (oscillatory shear) viscosity and elasticity measurements, elongational viscosity, dynamic surface tension, and structural recovery rates after transient deformation. Examples of how to relate such rheological data to performance problems of coatings were discussed.

MAUREEN M. LEIN, *Secretary*

PIEDMONT APR.

"Accelerating Weathering Tests"

"CURRENT USE AND TRENDS—ACCELERATING WEATHERING TESTS IN THE UNITED STATES" was the topic discussed by Mike Crewdson, of South Florida Testing Service.

Using slides to illustrate, Mr. Crewdson introduced the facilities of two test sites, located in Florida and Arizona. Since the climate of each, though different, remains

relatively constant year to year, these sites were determined to be in prime locations. An array of support stations for test samples and instrumentation to compile environmental data vital to successful correlation between cause and effect equip each site, he said. Through retrieving environmental data, such as amount of sunlight, UV radiation, and temperatures that a test sample undergoes, and correlating it to test sample results, standards of performance can either be established or fulfilled.

Mr. Crewdson continued by stating that many research and development projects cannot wait for a lengthy field testing. Therefore, accelerated weathering offers the user a rapid and precise testing procedure that can yield data that is comparable to product performance.

The accelerated weathering units present a controlled environment that can be equipped in choices of lighting elements and filters, he said. As in natural weather testing, the collection of environmental data from accelerated testing is important. Although the type of data collected will differ from that of natural weathering, successful cause and effect relationships can be obtained.

MICHAEL S. DAVIS, *Secretary*

PITTSBURGH APR.

"Effect of Surface Tension and Viscosity On Coatings Defects"

Federation President-Elect Joseph A. Bauer and Executive Vice-President Frank J. Borrelle were among the honored guests in attendance.

Following Mr. Bauer's discussion of upcoming Federation events, Mr. Borrelle spoke on current activities. Using slides to demonstrate, he detailed the Federation's budget, including sources of income and expenses. He reviewed the changes involving the Paint Research Institute and the decisions which will be made concerning it.

Mr. Borrelle recognized Society members in attendance who are actively involved in the paint industry on a national level. He concluded by inviting members to attend the 1985 Federation Paint Show to be held in St. Louis.

Society President-Elect Clifford Schoff, of PPG Industries, Inc., presented a paper co-authored with Percy E. Pierce, of PPG Industries, entitled "THE EFFECT OF SURFACE TENSION AND VISCOSITY ON COATINGS DEFECTS."

Mr. Schoff began by explaining that most of the major difficulties with organic

coatings have to do with surface tension forces. Water has a high surface tension, and many solvents lower with relationship to water. As temperature rises, surface tension usually drops, he said.

According to Mr. Schoff, it is important to determine the surface tension of solid material. To properly coat an object, the surface tension of the object should match as closely as possible the surface tension of the coating.

In addition, he stated that the liquid contact angle of specific liquids on solid surfaces is useful for estimating the surface tension of the solid. By measuring a series of liquid contact angles, a plot can be developed which reveals the surface tension. Mr. Schoff then gave the surface tensions of several solids.

He discussed coatings defects which are caused by two different surface tension levels which are close together, such as crawling and dewetting, cratering, pinholing, Benard cells, bumps and sinks, and bad edges and picture framing. To analyze these defects, the methods mentioned included microscopy, surface tension measurements, and observation of defect formation.

Mr. Schoff continued by stating that, once defects are identifiable, the primary method of solving the problem is to reduce the driving forces affecting surface tension variations. This can be done by following good formulating practices, he said. The right solvent, the right pigment-to-binder ratio, good pigment dispersion, and overall rheology are the keys. In addition, Mr. Schoff maintained that surfactants and low surface tension are helpful. In the end, the best results will be seen when the surface tension force causing the flow is reduced, and resistance to the flow is increased, he concluded.

JOSEPH L. MASCIA, *Secretary*

ST. LOUIS APR.

Education Night

Dr. Jim Stauffer, of the University of Missouri-Rolla, described the paint program at the university. He requested that members write to their State Representatives urging continued support of the program.

Dr. Judy Dunham, of St. Louis University, spoke on "COATINGS, A VIEW FROM THE IVORY TOWER." As part of her presentation, Dr. Dunham demonstrated a room temperature polymerization reaction which yielded a protective metal coating.

CHARLES L. GRUBBS, *Secretary*

THE BIG



CERVANTES CONVENTION CENTER
ST. LOUIS, MISSOURI OCTOBER 7-9

Elections

C-D-I-C

Active

AHR, ROBERT L.—Ohio Sealer Div., Dayton, OH.
BLIZZARD, DAVID L.—Talsol Corp., Cincinnati, OH.
FETTERMAN, THOMAS C.—Neyra Industries, Inc., Cincinnati.
MARTIN, WILLIAM R.—Ohio Sealer Div., Dayton.
PYGMAN, JR., HARLAN F.—DAP Inc., Tipp City, OH.
SCHOENER, THOMAS E.—Ashland Chemical Co., Columbus, OH.

Associate

BLACK, GERALD A.—Heubach Inc., Milford, OH.
LIKENS, CARNEY—Commercial Filters, Lebanon, IN.

CHICAGO

Active

CAFFERY, CHRISTINE A.—Thermark Co., Glenwood, IL.
COLLINS, ROBERT L.—The O'Brien Corp., South Bend, IN.
GANAS, IRENE C.—Thermark Co., Schererville, IN.
KAIN, ROBERT G.—Thermark Co., Schererville.
MAGUIRE, DEBRA J.—V.J. Dolan and Co., Inc., Chicago, IL.
MORRISON, LARRY—Schoole Corp., Chicago.
NELSON, DAN—S.C. Johnson & Son, Inc., Racine, WI.
PHARAZYN, CHARLES G.—Sherwin-Williams Co., Chicago.
PROWELL, DENNIS—The Enterprise Cos., Wheeling, IL.
RENKAR, JARRI J.—Ace Paint Div., Ace HW, Matteson, IL.
SHUSTER, FRANCINE—Midland Div., Dexter Corp., Waukegan, IL.
WALRABENSTEIN, MARCILLA R.—DeSoto, Inc., Des Plaines, IL.
WELLER III, EDWARD L.—Central Chemical, Glenview, IL.

Associate

BAUER, DANIEL J.—Neville Chemical Co., Deerfield, IL.
ESHOO, EDWARD—S.C. Johnson & Son, Inc., Oakbrook, IL.
FOLEY, J. BRENDAN—Day Glo Color Corp., Park Ridge, IL.
GRIFFITHS, RUTH V.—Union Carbide Corp., Chicago, IL.
JOESEL, KEVIN A.—Hammond Lead Products, Hammond, IN.
NICKELBERRY, HAROLD—Arco Chemical Co., Hinsdale, IL.

PALERMO, JOHN W.—Byk Mallinckrodt, Chicago.
TODD, BRUCE H.—S.C. Johnson & Son, Inc., Racine, WI.
WEISMAN, JACK—Carl Lechner Inc., Deerfield.
WINANDY, GEORGE J.—S-R Premier Inc., Addison, IL.

Retired

NIX, VERNON G.—Park Forest, IL.
WERCKENTHIEN, CHARLES—Melrose Park, IL.

CLEVELAND

Active

BLACK, DAVID—Man-Gill Chemical, Bedford, OH.
BRETZ, JOHN—Lubrizol Corp., Wickliffe, OH.
CARROLL, HOWARD E.—Sherwin-Williams Co., Grafton, OH.
DONOVAN, PATRICK K.—Man-Gill Chemical, Bedford.
FIGOLI, ANDREW N.—Jamestown Paint & Varnish Co., Jamestown, PA.
GLIHA, SUSAN M.—Glidden-DPJRC, Strongsville, OH.
HOUSTON, JOEL E.—PPG Industries, Inc., Cleveland, OH.
KONDILAS, JOHN T.—Dylon Industries, Berea, OH.
KONTOS, EVANGELOS A.—PPG Industries, Inc., Cleveland.
MCELHANEY, KEVIN E.—Jamestown Paint & Varnish Co., Jamestown.
ONDERAK, DALE G.—Scheller Inc., Kent, OH.
PARISH, JAMES V.—Consultant, Brecksville, OH.
REED, DENNIS M.—Man-Gill Chemical, Bedford.
RICHARDS, GEORGE E.—PPG Industries, Inc., Cleveland.
SAJNER, GEORGE S.—Man-Gill Chemical, Bedford.
SHANNON, RICHARD M.—Jamestown Paint & Varnish Co., Jamestown.
SOLOMON, MARK S.—Man-Gill Chemical, Bedford.
TRUAX, GEORGE T.—Man-Gill Chemical, Bedford.
VICHA, SUSAN K.—PPG Industries, Inc., Cleveland.
WINNER, PETER P.—Glidden Ctg. & Resins Div., Strongsville.
WISNIEWSKI, KARL M.—Man-Gill Chemical, Euclid, OH.
ZORSKA, ROMAN—Glidden Ctg. & Resins Div., Strongsville.

Associate

COUGHLIN, MARTIN—Van Waters & Rogers, Cuyahoga Hts, OH.
DOUGHERTY, JON—New Jersey Zinc Co., Fairlawn, OH.
NORRIS, CHRIS—Van Waters & Rogers, Cuyahoga Hts.

HOUSTON

Active

ZERMENS, NASH—Spartan Color Corp., Houston, TX.

LOUISVILLE

Active

CHESTER, GARY E.—Kentucky Paint Mfg. Co., Lexington, KY.
DOYLE, JAMES E.—Reliance Universal, Inc., Louisville, KY.
HOLLOWAY, JEROME K.—Reliance Universal, Inc., Louisville.
HORGER, RICHARD A.—Sherwin-Williams Co., Richmond, KY.
IRIZARRY, RICK—Celanese Specialty Resins Co., Jeffersonton, KY.
Tso, Su C.—United Catalysts, Inc., Louisville.

Associate

BOLLENBACH, DENNIS—Celanese Specialty Resins Co., Louisville, KY.
CLANTON, WAYNE A.—Spartan Color Corporation, Warren, AR.
MILLER, LEO A.—LA Miller Co., Louisville.

MONTREAL

Active

FOSTER, GUY—Sico, Inc., Longueuil, Quebec, Can.
GRENON, PAUL A.—Sico, Inc., Longueuil.
LAFONTAINE, GAETAN—Sico, Inc., Longueuil.
LALUMIERE, PIERRE—Sico, Inc., Longueuil.
PEPIN, LUC—Sico, Inc., Longueuil.

NEW ENGLAND

Active

KHOKHANI, ASHOK C.—Polyvinyl Chemical, Ind., Wilmington, MA.

Associate

GRUNSTRA, THOMAS W.—Whittaker Clark & Daniels, Inc., South Plainfield, NJ.
LYONS, MICHAEL R.—Ashland Chemical Co., Westfield, MA.
STERN, DICK—New England Aerosol & Pkg., Woburn, MA.

NEW YORK

Active

BROWNING, ROBERT J.—John L. Armitage & Co., Newark, NJ.
COUGHLIN, ROBERT D.—Isis Chemicals Inc., Stamford, CT.

GEORGALAS, NICK—Inmont UTC, Clifton, NJ.
 MINEROWICZ, JOHN P.—Benjamin Moore & Co., Newark, NJ.
 STAMCHFIELD, PETER M.—Isis Chemicals Inc., Stamford.
 ULLAH, SAADAT M.—Hoboken Paints, Inc., Lodi, NJ.

PACIFIC NORTHWEST

Active

ARIE, JANSEN—Preswitt Manufacture Ltd., Surrey, BC, Can.
 AYERS, TIM—Willamette Valley Co., Eugene, OR.

Associate

FOLTZ, CHARLES A.—Northwest Pump & Equipment, Seattle, WA.
 MITCHELL, JOHN J.—Chemical Distributors Inc., Portland, OR.

HOLLIS, CHARLES H.—GSA, Federal Way, WA.
 MATHES, HUBERT D.—Olympic Stain Co., Seattle, WA.
 NOZEWSKI, STEFAN P.—International Paints (Canada) Ltd., North Vancouver, BC, Can.
 ROBERTS, ALLAN W.—Intel Corporation, Hillsboro, OR.
 WASIK, JAMES A.—Olympic Stain Co., Seattle.

QUINN, FRANCIS—DeGussa Canada Ltd., Richmond, BC, Can.

TORONTO

Active

ABBOUD, GEORGE E.—C-I-L Paints, Inc., Toronto, Ont., Can.
 BOSE, NIHARENDU—Nuodex Color Trend, Bramalea, Ont., Can.
 CHAOUI, ANTOINE—Glidden Co. Ltd., Toronto.
 COOPER, ROBERT E.—Cuprinol Korzite Ltd., Guelph, Ont., Can.
 COURTNEY, ROBERT J.—Nuodex Color Trend, Bramalea.
 DAY, JOSEPH T.—Cuprinol Korzite Ltd., Guelph.
 EGAN, FRANK—St. Lawrence Resin Prods. Ltd., Mississauga, Ont., Can.
 HANSMANN, JOSEPH—P.E.C. Extrusions, Markham, Ont., Can.
 KOE, STEVEN—Selectone Paints Ltd., Weston, Ont., Can.
 LUM-SHUE-CHAN, LLOYD—Cuprinol Korzite Ltd., Guelph.
 MCCOMB, WAYNE—Canada Glue, Brantford, Ont., Can.
 MONACO, CARLO A.—Tremco (Canada) Ltd., Toronto.
 OLIVEIRA, ZACHARY M.—Cuprinol Korzite Ltd., Guelph.
 RAHMAN, LILLIAN G.—Nacan Products Ltd., Scarborough, Ont., Can.
 RIVAS, ALFREDO—Selectone Paints Ltd., Toronto.
 SONDHI, D.P.—C-I-L Paints, Inc., Toronto.
 TOOF, JACK T.—duPont Canada Inc., Mississauga.
 VINCE, TOM—Quadra Chemicals Ltd., Mississauga.
 WRIGHT, DOUGLAS A.—C-I-L Paints, Inc., Concord, Ont., Can.
 YIP, CHAK K.—Canadian General Electric, Toronto.

Associate

BLAND, JOHN S.—Nacan Products Ltd., Toronto, Ont., Can.
 BRIDGES, RUSSELL B.—Carbo Chemicals, Toronto.
 DEMARCHI, RICHARD D.—Debro-Div. Premetalco, Brampton, Ont., Can.
 LEVY, EDWARD—Frank E. Dempsey & Sons Ltd., Toronto.
 LIAW, KENNY—Harrisons & Crosfield (Canada) Ltd., Toronto.
 RUSSELL, KEVIN—L.V. Lomas Chemical Co., Mississauga, Ont., Can.
 STARK, PAUL—SICO Paints Inc., Rexdale, Ont., Can.
 STEIBELT, M.—L.V. Lomas Chemical Co., Mississauga.
 WENTLANDI, GEORGE J.—Anachemia Solvents Ltd., Mississauga.
 WILSON, R. DALE—Columbian Chemicals Canada Ltd., Hamilton, Ont., Can.

Educator/Student

RUDIN, ALFRED—University of Waterloo, Waterloo, Ont., Can.

AFFILIATED

DUBEY, GIRISH C.—Hempel's Marine Paints, Dammam, Saudi Arabia.

Sparkle Silver® 3622



There's More Than Meets The Eye

It's ordinary to rate the color of non-leafing aluminum pigments in terms of "whiteness." But, SPARKLE SILVER® 3622 is *extra-ordinary!* Now innovative formulations achieve dazzling new effects of radiant "silver"—bright, glowing, effervescent, glamorous.

Enhance your perception... take a closer look at your ordinary



Specialists in Aluminum Pigments
SILBERLINE
 MANUFACTURING CO., INC.

Lansford, Pennsylvania 18232
 Phone (717) 645-3161 TWX No. 510 659 8508
 Plants in Lansford; Decatur, Indiana; and Leven, Fife, Scotland

non-leafing aluminum pigment. Then discover SPARKLE SILVER® 3622 and take advantage of its exceptional properties. Greater flash! Greater sparkle! Innumerable pinpoint of silver glitter when applied as part of a heretofore "conventional" coating.

SPARKLE SILVER® 3622—another real eye-opener from SILBERLINE!

Five Members of Federation to Present Papers At XVIIth FATIPEC Congress in Switzerland

Five members of the Federation of Societies for Coatings Technology will present papers at the XVIIth FATIPEC Congress in Lugano, Switzerland, September 23-28, 1984. FATIPEC is the Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe.

Milton A. Glaser, industry consultant and a Past-President of the FSCT, will present "Barriers to Innovation (The R/D Production Interface)" on behalf of the Federation at the plenary session on September 24.

The other member-speakers will be:

J.L. Scott, of South Florida Testing Service—"New Developments in Laboratory Accelerated Test Methods for Coatings."

Dr. Zeno Wicks, retired from North Dakota State University, Dept. of Polymers & Coatings—"Viscosity of Oligomer Solutions."

Akzo Coatings America Formed

Akzo Coatings, of The Netherlands, has formed a new company, Akzo Coatings America, Inc., to coordinate its coatings operations throughout the North American market.

Akzo Coatings America includes the Wyandotte Paint Products Div., with responsibility for the automotive, coil, general industrial, and sign industries; and the Sikkens Div., which supplies car refinishes. Akzo Coatings America also includes a wholly-owned subsidiary, Lan-Chem Corporation, a manufacturer of specialty resins for the paint and printing ink industries.

Cees Zaai will serve as Chairman of the Board for the new company. Acting as President and Chief Executive Officer will be Charles A. Brethen III. Other executive personnel include: Donald M. Howell, Jr.—Vice-President of Sales; Dr. Taki Anagnostou—Vice President of Research and Development; and George Findling—Vice-President of Finance and Planning. Dr. Anagnostou is a member of the Detroit Society and serves as a member of the Federation's Editorial Review Board.

Dr. D.T. Wu, of the DuPont Co.—"Effects of Solvents on Polymer-Polymer Compatibility."

Donald E. Brody, of Skeist Laboratories and a Past-President of the New York Society—"Revolutions in the Coatings Industry."

Other Americans on the program are:

Dr. Henry Leidheiser, Jr., of Lehigh University—"Migration of Species Through Organic Coatings and Free Films Under Potential Gradient."

Jay R. Wilner, Jr.—"High Performance Anti-Corrosive Coatings in the U.S."

The Congress will be held in Lugano's Convention Center. The total scientific program will consist of more than 100

individual papers presented in one of the three official languages of FATIPEC: French, German, and English. Simultaneous translation will be provided for the plenary sessions only.

Accompanying the scientific program will be Fatipexo, an exhibit featuring 28 European companies who supply the coatings industry.

Further information on the Congress is available from: Congress Secretariat, Interconversion Ltd., c/o Swissair, Postfach, CH-8058 Zurich Airport, Switzerland.

The President of FATIPEC, 1982-84, is Romeo Capanni, of George Fey & Co. AG, St. Margrethen, Switzerland.

270 Attend "Back to Basics" Symposium Of Pacific Northwest Society

A registered attendance of 270 (201 men, 69 ladies) was recorded at the Annual Symposium of the Pacific Northwest Society for Coatings Technology, May 3-5, in Seattle, WA.

Nine papers were presented under the theme, "Back to Basics":

- (1) "Weathering Interactions on Treated and Untreated Wood Surfaces"—Bill Feist, of Forest Products Laboratory
- (2) "Defoamers—Theory and Practice"—Ken Breindell, of Diamond Shamrock Corp.
- (3) "Colorant Technology"—Loran Manhart, of Nuodex, Inc.
- (4) "One-Coat Painting—Fact or Fantasy"—F.B. Burns, of E-Z Paint Corp.
- (5) "The Phenomena of Flooding and Floating"—Wolfgang Zinnert, of Byk-Mallinckrodt
- (6) "Styrene, EVA, and Acrylic Modified Emulsions—The Basics"—Bruce Henshaw, of McCloskey Varnish Co.
- (7) "Use of Drier in Conventional High-Solids and Waterborne Coatings"—Ray Hurley, of Interstab Chemicals, Inc.
- (8) "Additives to Reduce Paint Costs While Maintaining Paint Qual-

ity"—Bob Washburne, of Rohm and Haas Co.

- (9) "Iron Oxide Pigments"—George Cable, of Pfizer, Inc.

At the annual business meeting, the following slate of officers was elected for 1984-85: President—Otwin Schmidt, of Helzer Canada Ltd.; President-Elect—Gerry McKnight, of Rodda Paint Co.; Secretary—Dennis Hatfield, of J.F. Shelton Co.; and Treasurer—Yvon Poitras, of General Paints.

Bill Shackelford, Administrative Secretary, announced a new high in Society membership—233 (168 Active members, 55 Associate, and 10 other classes).

The annual sports competition was an air-propelled three-ball race in the hotel ballroom. It was won by the Vancouver Section.

The Symposium Committee was composed of: Mr. Hatfield, Chairman, Emil Iraola, John Bartlett, Kathy Bitz, Steve Briggs, Robert Hogg (Society President), Diane Hatfield, Hossein Varzandeh, Fred Schmucker, and Bill Walsten.

The 1985 Symposium will be held at the Empress Hotel in Victoria, B.C., April 25-27.

Du Pont Sponsors Industrial Safety Seminars

Industrial safety will be the focus of three seminars sponsored by the Applied Technology Division of Du Pont Company, scheduled from July 31-August 23 in Buck Hill Falls, Pocono Mountains, PA.

"Managing Safety: Techniques That Work for Line Supervisors" (July 31-August 2) is designed to help improve safety performance by first and second line supervisors.

"Process Hazards Management" (August 7-9) will serve as a review for safety personnel, process engineers, and supervisors in both chemical processing and petrochemicals industries, as well as those involved with paper, pharmaceuticals, and electric utilities.

"Managing Safety: Techniques That Work for the Safety Pro" (August 21-23) is designed for safety managers, supervisors, engineers, and others concerned with the implementation and monitoring of plant safety programs. It includes a review of safety fundamentals, a presentation of new techniques, and discussion of specific problems.

For additional information, contact Du Pont Company, Applied Technology, Wilmington, DE 19898.

CALL FOR PAPERS

ASTM Symposium on Testing of Metallic and Inorganic Coatings

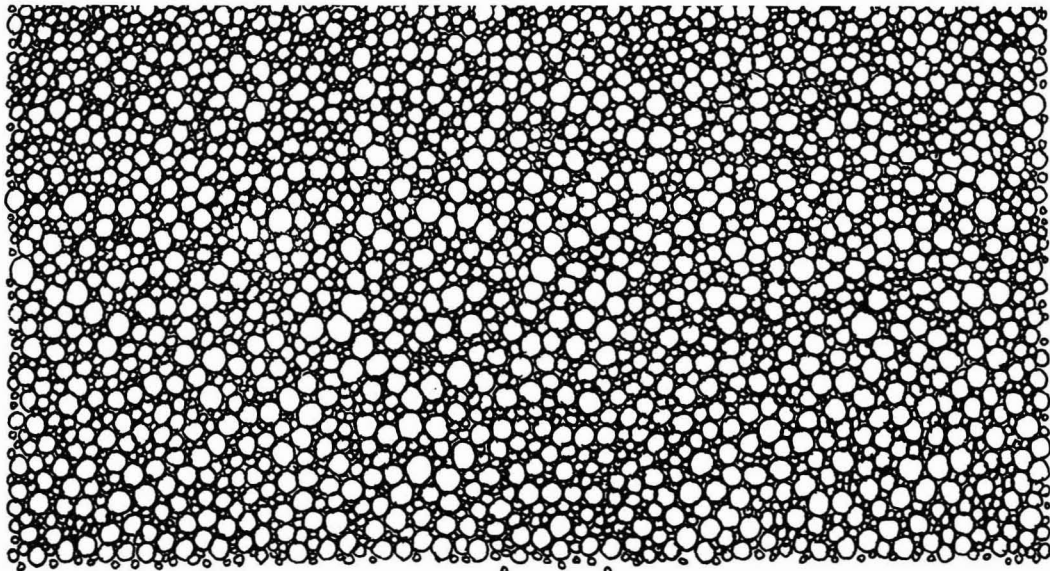
The first symposium on "Testing of Metallic and Inorganic Coatings" will be sponsored by the American Society for Testing Materials' (ASTM) Committee B-8 and its Subcommittee B-8.10 on April 14-15, 1986, in Chicago, IL.

The symposium will deal with the characteristics of coatings that are important to the functions of the coating. These include, but are not limited to: thickness; adhesion; structure; mechanical, electrical, optical, and tribological properties; corrosion resistance; reference materials; and automated testing.

Papers dealing with these characteristics are being solicited. Three types of papers are desired: those focusing on the examination and illumination of the nature of the characteristic with a discussion of the relationship of the characteristic to the performance of the coating; those dealing with state-of-the-art testing of the characteristic; and those reports of new work in testing.

The coatings for which tests are designed may be produced by: electro, electroless, immersion, or mechanical plating; the vacuum processes of evaporation, sputtering, ion plating, and chemical vapor deposition; thermal spray anodization; and chemical conversion.

Papers on other related topics are welcome. All papers are to be previously unpublished. Prospective authors should submit a 300-500 word abstract and an ASTM Paper Submittal Form by January 1, 1985 to Kathy Greene, ASTM Publications Div., 1916 Race St., Philadelphia, PA 19103. For additional information, contact Teri Carroll, ASTM Standards Development Div. at the above address.



Cut the cost of caulk with CAMEL-FIL®. The lowest cost filler with the least room for resin.

The problem with many fillers is that you end up using more resin than you'd like.

But low-cost CAMEL-FIL® is a calcium carbonate with a unique particle size distribution that provides exceptionally high load-

ing. So you reduce your resin costs, while using a filler that's low in cost too. Call or write for details: Genstar Stone Products Company, Executive Plaza IV, Hunt Valley, **GENSTAR** Maryland 21031. (301)628-4225.

People

Hampton Paint Manufacturing Co., Hampton, VA, was recently named the national prime contractor of the year by the U.S. Small Business Administration. **Colin Penny**, President of Hampton Paint, was honored during Small Business Week, May 6-12, which is proclaimed annually by the U.S. President to honor the nation's 14 million small businesses. Mr. Penny is a member of the Baltimore Society and the Federation's Technical Advisory Committee.



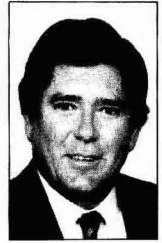
C. Penny



W.B. Bartelt



R.A. Katherine



J.D. Boggess

NL Chemicals/NL Industries, Inc., Hightstown, NJ, has appointed **Joseph L. Waldman** Manager, Business Planning and Product Strategy. Dr. Waldman was previously Manager of Planning/Analysis.

McWhorter, Inc., Minneapolis, MN, has appointed **Paul Sara** to the position of Technical Director. Mr. Sara is a member of the Northwestern Society.

Russell H. Leopard has joined the Jones-Blair Co., Dallas, TX, as Technical Manager. He will direct the activities of the chemical coatings laboratory.

John C. Kulnane has been appointed Technical Manager of Ameritone Paint Corp., Long Beach, CA. Mr. Kulnane is a member of the Los Angeles Society.

John S. Dumble has been elected President of Glidden Coatings & Resins Div., SCM Corp., Cleveland, OH. Mr. Dumble formerly held the position of Executive Vice-President. He succeeds **William D. Kinsell, Jr.**, who retired.

Ferro Corp., Cleveland, OH, has announced the following appointments: **Sidney J. Feldman** has been named Specialty Products Coordinator; **Miles E. Curtis** to the position of Central District Manager; and **David K. Hanes** has been named a Sales/Service Engineer for metal coatings.

The board of directors of Englehard Corp., Menlo Park, NJ, elected **Orin R. Smith** President and Chief Executive Officer. Most recently, Mr. Smith, a director, served as Senior Executive Vice-President and acting Chief Executive Officer of Englehard.

U.S. Paint, Division of Grow Group Inc., St. Louis, MO, has appointed **Charles Grubbs** to the position of Technical Director. Mr. Grubbs serves as Secretary of the St. Louis Society.

Rust-Oleum Corp., Vernon Hills, IL, has announced the promotion of **W.B. Bartelt** to the position of Executive Vice-President. Among Mr. Bartelt's responsibilities will be the direction and coordination of the domestic sales and marketing groups, international research and development, and administration. He is a Past-President and Executive Committee member of the Chicago Society.

Also promoted by Rust-Oleum were the following: **Donald C. Fergusson** to Senior Vice-President—Marketing and Sales; **William R. McCarrell** to Vice-President—Industrial Business Group; **John R. Simons, Jr.**, to the position of Director—Industrial Sales; and **Richard W. Manning** to Director—Manufacturing. Mr. McCarrell is a member of the Chicago Society.

Robert A. Katherine, Chairman and Chief Executive Officer of McCloskey Varnish Co., Philadelphia, PA, has been elected to the Board of Directors of the Intra-Science Research Foundation, an educational and scientific foundation involved in the dissemination of scientific knowledge and support of independent research.

California Products Corp., Cambridge, MA, has appointed **Bonita Benhayon** Advertising and Merchandising Manager. Ms. Benhayon had been the Associate Director of Public Relations for the National Paint and Coatings Association, where she managed the "Picture It Painted" campaign.

Barrett Varnish Co., Cicero, IL, has announced the appointment of **K.D. "Ron" Patel**, as Laboratory Manager. Mr. Patel will oversee the laboratory operations, technical service, quality control, and compliance support activities for the company.

At its recent annual meeting, Material Marketing Associates, Inc. (MMA) elected **James D. Boggess** as President for a two-year term. Mr. Boggess succeeds the late **Howard S. McCullough**.

Mr. Boggess, President and CEO of Wm. B. Tabler Co., Louisville, KY, has been a member of MMA since 1976, and has served on its Board of Directors since 1977.

Also elected were **James A. Grierson**, of APCO Industries Ltd., Toronto, Ont., as Vice-President; and as members of the Board, **Ren L. Ridolfi**, of Matteson-Ridolfi, Inc., Detroit, and **Robert F. Walsh**, of Walsh & Associates, St. Louis.

MMA, an association of leading marketing representatives in the paint, ink, and coating industries, sponsors Constituent Society awards at the Federation's Annual Meeting.

Arizona Chemical Co., Fair Lawn, NJ, has elected **Creed C. Greer** Vice-President of manufacturing. He formerly held the position of Plant Manager of the firm's Panama City, FL plant. Succeeding Mr. Greer as Plant Manager will be **Robert W. Sombathy**.

Shell Chemical Co., Houston, TX, announced the assignment of **Victor F. Figurelli** as Manager—quality improvement. In this newly created position, he will be responsible for managing the quality improvement process within the firm's polymers and catalysts organization.

The Midland Division of The Dexter Corp., Waukegan, IL, has announced the following appointments: **Jon Lyyski** has been promoted to the position of Analytical Chemist; **Bertram Gardner** has been promoted to Senior Development Chemist; and **Bridget Abraham** has joined the Midland Div. as Senior Development Chemist, New Ventures Laboratory.

Cees Zaal has been named Chairman of the Board for the newly formed Akzo Coatings America, Inc., the North American operation of Akzo Coatings, of the Netherlands. Assuming the responsibilities of President and Chief Executive Officer will be **Charles A. Brethen, III**. Other executives named are: **Dr. Taki Anagnostou**—Vice-President of Research and Development; **Donald M. Howell, Jr.**—Vice-President of Sales; and **George Findling**—Vice-President of Finance and Planning. Dr. Anagnostou, a member of the Detroit Society, currently serves on the Federation's Editorial Review Board.

Morehouse Industries, Inc., Fullerton, CA, announced the appointment of **Robert F. Blackburn** as Manufacturing Manager. Mr. Blackburn has contributed over 15 years' experience to the production, industrial engineering, and management of factory operations.

Lee Christens has been named Project Manager for coatings products at Dow Chemical U.S.A.'s Inorganic Chemicals Dept., Midland, MI.

The National Coil Coaters Association (NCCA) has elected **James S. Smith** as President. Mr. Smith, the President of Roll Coater, Inc., Greenfield, IN, represents Active Member coil coaters and will serve a one-year term.

Also elected by NCCA's Board of Directors were the following: **William A. Boyd**, of Vail Rubber Products Corp., Hammond, IN, was re-elected Vice-President representing the Associate Member firms who supply metals, coatings, equipment, and other services; **Francis D. O'Neill**, of Teledyn Rodney Metals, New Bedford, MA, was elected Vice-President, representing the Active Member coil coaters; and **John H. Geyer**, of Total Tech Inc., Richboro, PA, was re-elected Secretary/Treasurer.

Carter Coatings Corp., Tampa, FL, has named **Bill Jones** to the position of Vice-President and General Manager.

William S. Laycock has joined EM Chemicals, Hawthorne, NY, as Technical Service Manager for the Plastics and Coatings Group. He formerly served as Chairman of the Color and Appearance Division of the Society of Plastics Engineers.

Troy Chemical Corp., Newark, NJ, has named **Robert T. Maher** Manager, Commercial Development. In his new position, Mr. Maher will be responsible for all marketing activities for new products and technologies, along with the development of new markets for existing product lines.

In a restructuring of its Water Soluble Polymers and Coatings groups, Hercules, Incorporated, Wilmington, DE, has announced the following appointments: **Thomas C. Davis** to National Sales Director; **R. Stephen Sumption** to Marketing Director; and **John L. Lawes** to Market Development Director.

Angus Chemical Co., Northbrook, IL, has announced the following appointments: **Robert J. Frederick** to the position of Vice-President of planning and research; **Richard S. Signorelli** to Vice-President for corporate development; **Donald E. Kepler** to Administrative Director of sales and marketing; and **Douglas E. Dunn** as Sales Representative for specialty chemicals on the West Coast.

Robert G. Miotke has been promoted to Northern Regional Manager of Angus Chemical Co. Mr. Miotke is a member of the Chicago Society. Joining the technical support center of Angus Chemical as a Senior Research Chemist at the McCook, IL facility is **Dr. Morris L. Fishman**.

H. David Medley has rejoined Celanese Chemical Co., Dallas, TX, as Vice-President of marketing. He is responsible for sales and marketing of the company's products in domestic and overseas markets.

David Dempsey has been appointed to the position of Market Development Manager of Color Corporation of America, a subsidiary of The Valspar Corp. He will be headquartered in Rockford, IL.

Obituary

Charles R. Harvey, Vice President of Boehle Chemicals, Inc., Southfield, MI, died on April 12. He was 42.

At the time of his death, Mr. Harvey was President of the Detroit Color Council and an active member of the Detroit Society, the Detroit Paint and Coatings Association, the Chemical and Allied Industries Association, and the Detroit section of the Society of Plastics Engineers.

Marvin J. Soderberg, Vice-President of manufacturing for the Spencer-Kellogg Division of Textron, Inc., died on April 13, at the age of 46.

If they can make it here, they'll make it anywhere.



When's the last time you saw "digging a well" on someone's résumé? Working in the Peace Corps is not your average everyday job.

Whatever it takes to be Peace Corps volunteers, it's a way of working that develops a resourcefulness and a degree of self-reliance that volunteers use long after they've come home. Anyplace they work. On any job they're given.

Hire a former Peace Corps volunteer, and put that experience to work on your "toughest job." Call Peace Corps toll-free, 800-424-8580 (ext. 76) to tell them about job possibilities for returned volunteers. Or if you know of those who might like to volunteer, use the same phone number (ext. 93) to put their experience to work where it can do a world of good.

Peace Corps

The toughest job you'll ever love.

A Public Service of This Publication 

Book Review

ALUMINUM AND BRONZE FLAKE POWDERS

Written by
G.W. Wendon

Published by
Electrochemical Ltd.
Ayr, Scotland
\$46.00

Reviewed by
H. van Oene
Ford Motor Co.
Dearborn, MI

This book should be a welcome addition to the technical literature. In his preface, the author states that his book provides the first comprehensive survey of the production, properties, and application of aluminum and bronze flake powders and, as such, the author should be commended for his efforts. For supporting references, the author draws mainly on the extensive patent literature. Besides properties and applications, this book also reviews standards, testing methods and, very importantly, the safety and health aspects of the production and handling of aluminum and bronze flake powders. This chapter draws attention to the fact that replacement of stearic acid, as a milling lubricant, by mineral oil changed the aluminum flakes from essentially harmless to potentially very toxic. Apparently aluminum flake powder coated with stearic acid is stable to physiological saline solutions; when the powder did not contain stearic acid they were attacked, even at room temperature.

The book covers various applications, but does not discuss details of mechanism. Corrosion protection by zinc-rich primers is mentioned; the brief electrochemical excursion on page 40 is, however, rather mystifying. The importance of controlling the pH in the avoidance of gassing is only very indirectly alluded to. Factors which control the appearance of metallic paints are not discussed.

Nevertheless, these are minor criticisms. Most paint technologists are aware of these matters and have developed their own, usually proprietary, technology.

In conclusion, I strongly recommend this book, and would have appreciated it very much if a similar work had been available during my work on the development of powder metallics.

SURFACE COATINGS Volume I: Raw Materials and their Usage

Prepared by
The Oil and Colour Chemists'
Association, Australia

Published by
Chapman and Hall
New York, NY
1983, 408 pp, \$56.00

Reviewed by
Dr. Thomas J. Miranda
Whirlpool Corp.
Benton Harbor, MI

This volume is a completely rewritten version of an earlier edition published in 1974 which this reviewer had the privilege to review. The publishers have made several significant changes which are very welcome. First, the size of the book is smaller and the binding very

much improved. Second, and very important, there is an index which the first volume did not have.

The first volume deals with raw materials and their usage. A second volume deals with basic manufacture, application and technology. Volume one begins with a history and introduction to polymer chemistry. It then covers vegetable oils, alkyds, amino, phenolic, urethane, epoxy, silicone and acrylic resins. Six chapters are added on emulsion polymers followed by water-soluble resins and solvents, pigments, driers and additives.

The 30 chapters are written in a pedagogical style designed to help the beginner as well as those active in the field. At the end of the volume numerous conversion tables are included, making this a practical and useful tool for the coating chemist.

The only possible drawback is the lack of additional references which would increase its value. This book is highly recommended and the Australian Oil and Colour Chemists' Association are congratulated for undertaking this important task.

1983 BOUND VOLUMES

A limited number of bound volumes of the Journal of Coatings Technology are available for sale. These books make a handsome and lasting addition to any library. In addition to 1983, volumes for the years 1974, 1979, and 1980 are also available. Price—\$50.00

Bound Volumes may be ordered from:

**Federation of Societies for Coatings
Technology**
1315 Walnut Street
Philadelphia, Pennsylvania 19107
(215) 545-1506

Please make checks payable in U.S. funds.
Pennsylvania residents, please add 6% sales tax.

Filtration

An eight-page reference filtering guide designed to enable selection of the most efficient filter bag for any given service has been published. Details include the proven designs available, the natural and synthetic media choices, micron rating range, operating conditions, and methods of calculating flow rates. For additional information, contact American Felt & Filter Co., Box 951, Newburgh, NY 12550.

Color Control Software

Software for color matching, batch correction, and color quality control is the subject of recently released literature. For more information, contact Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08540.

Phenyl Acid Phosphate Catalysts

Phenyl acid phosphates used as acid catalysts to reduce resin curing time and temperature are described in a new bulletin. Available as PAP-100, (100% concentration) and PAP-75, (75% concentration in butanol), they are useful in ureaformaldehyde, epoxy, and urethane systems. For a copy of the bulletin, contact Hodag Chemical Corp., 7247 N. Central Park Ave., Skokie, IL 60076.

Valves

A 12-page catalog featuring precision selector valves, stack valves, venting valves, and electronic and pneumatic operators is now available. The catalog is a reference for specifying self-lubricating, corrosion resistant selector valves for manual or automatic operation. For more information, contact S.M. Lewis, President, Conant Controls, Inc., 427 Riverside Ave., Medford, MA 02155.

Epoxy Coating

Information on a new fire-protective intumescent epoxy coating for petrochemical and other industrial applications is now available. The new coating is designed for application on structural steel supports and vessels used in hydrocarbon processing and other industrial plants. It provides corrosion protection and chemical resistance. For additional details, contact PPG Industries, Inc., 8 North, One PPG Place, Pittsburgh, PA 15222.

Pigment

Information is now available on a new violet color which is recommended for product finishes requiring durability and resistance to long-term weathering exposure. A sample and technical data can be obtained by contacting The Mearl Corporation, 41 East 42nd St., New York, NY 10017.

Solid-Hiding Stain

Information on a new system that provides a durable solid-hiding stain to beautify and protect old weathered, untreated exterior wood has been published. The system is also designed for application over faded or badly weathered stain and to cover hard-to-coat weathered or previously stained T-111 plywood and hardboard. For additional information, write to The Flood Company, P.O. Box 399, Hudson, OH 44236-0399.

Iron Oxide

Literature is available on a new iron oxide that can be added to organic pigments without causing haziness and milkiness. This product is designed to offer increased opacity at lower prime pigment loadings. For information, contact Reichard-Coulston, Inc., 1421 Mauch Chunk Rd., Bethlehem, PA 18018.

Safety Alert System

A significant problem on multi-employer worksites is the transfer of information regarding hazards from one trade to another. A new document, D 4257, "Practice for Design and Use of Safety Alert System for Hazardous Work Locations in the Coatings and Linings Industry" addresses this problem. For copies, contact ASTM Sales Service, 1916 Race St., Philadelphia, PA 19103.

Solvent Selector

A solvent selector for coatings is available in an eight-page booklet. Data on solvents, co-solvents, couplers, diluents, and plasticizers are presented. A listing of 36 solvents gives physical properties, shipping and labeling requirements, as well as status under Rule 66-type air pollution regulations. Copies of F-7465W, "Solvent Selector for Coatings," can be obtained from Union Carbide Corp., Solvents & Coatings Materials Div., Dept. K3442, Danbury, CT 06817.

Fire Suppression

A two-color, four-page brochure describing pre-engineered fire suppression systems for industrial hazards found in spray paint booths, quench tanks, etc., is now available. The brochure outlines how dry chemicals break the combustion chain, how the automatic fire suppression systems work and describes a choice of three automatic discharge devices. For more information, contact Chemetron Fire Systems, member of Allegheny International, Route #50 & Governors Hwy., Monee, IL 60449.

Polymerization

Benefits and new techniques in the use of Natrosol® hydroxyethylcellulose (HEC) for emulsion polymerization systems are described in a 12-page technical information bulletin. The bulletin includes graphs and tables which list properties and uses of the material, along with important effects. For a copy of technical information bulletin VC-450B, contact: Hercules Incorporated, Product Inquiry, Hercules Plaza, Wilmington, DE 19894.

CLASSIFIED ADVERTISING

LABORATORY PERSONNEL REQUIRED

To keep up with above average growth Guertin Bros. Coatings and Sealants will need 7-10 additional people over the next 18 months.

Resin Research
Prepolymer Research
Analytical Analysis interpretation
Industrial/Retail Coatings
Development
Industrial/Retail Sealants
Development
Heavy Duty Chemical/abrasion-resistant coatings development
Batch shader

Guertin's offer advancement, security, group benefits, continual training and learning, medium and high technology projects.

Send all resumes in confidence to:

Tony Guertin, Jr.
Guertin Bros. Coatings and
Sealants
270 Assiniboine Avenue
Winnipeg, Manitoba
R3C 0X6

Pneumatic Adhesion Tester

A bulletin is now available on a portable pneumatic adhesion tester designed to provide data on the bond strength of coatings to their substrates. For a full brochure on the pneumatic adhesion tester or adhesion testing services, write SEMicro, 620 Hungerford Dr., Ste. 12, Rockville, MD 20850.

Pigment Dispersions

Pastes comprised of pigments dispersed in polyester resins are described in new literature. Types of pigments used in these dispersions include heat stable, light stable, organic, inorganic, and FDA. For information, contact Pigment Dispersions, Inc., P.O. Box 412, Edison, NJ 08818.

Tubing

A flexible, transparent tubing formulated for handling most gasolines, kerosenes, heating oils, and cutting compounds has been introduced in new literature. For information, contact Thermoplastic Processes, Inc., 1268 Valley Rd., Stirling, NJ 07980.

Spectrophotometer

Information is available on a new color spectrophotometer designed for flexibility. When interfaced with a computer color control system, it provides spectral measurements of color samples in research, production, and quality control applications. Literature can be obtained from Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08540.

Urethane Elastomeric Base Coat

Literature is available on a new urethane elastomeric base coat intended for use as a roofing membrane on urethane foam, concrete, and plywood. For more details, contact Gaco Western, Inc., P.O. Box 88698, Seattle, WA 98188.

Storage Tanks

Information can now be obtained on cone bottom, stainless steel ribbed tanks designed to withstand maximum loads without rupture or spills. Capacities range from 2,100 to 7,300 gallons. For information, contact Certified Equipment & Mfg. Co., P.O. Box 298, Springfield, IL 62705.

Phenolic Resins

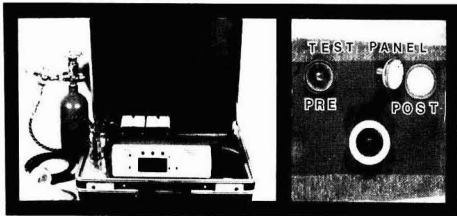
A 36-page booklet describing durable coatings based on a phenolic resin has been recently issued. Applications noted include floor coatings, spar varnishes, porch and deck enamels, metal primers, can coatings, government specification vehicles, and ready-mixed aluminum maintenance paints. "Durable Coatings Based on UCAR Phenolic Resin CK-2400," designated F-42357A, can be obtained from Union Carbide Corp., Specialty Chemicals Div., Dept. K3442, Danbury, CT 06817.

Organotin Biocides

A 68-page booklet which reviews the area of anti-fouling with emphasis on recent developments with organotin biocides is now available. Topics dealt with include the problem of marine anti-fouling, the mode of action of organotin biocides, the slow-release concept and related biocidal systems. For a copy of Publication No. 624, contact Tin Research Institute, Inc., 1353 Perry St., Columbus, OH 43201.

ADHESION

TESTING OF
COATINGS
"IN THE FIELD OR LAB"



"SYSTEM 2000 Pneumatic Adhesion Tester"

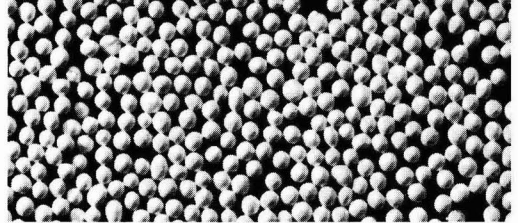
- Portable
- Accurate
- Digital Readout
- QC Measurements

SEMIcon

Div. of M.E. Taylor Engr. Inc.
11506 HIGHVIEW AVENUE
WHEATON, MD. 20902

(301) 251-0642 or (301) 942-3418

PROBLEM-FREE GRINDING MEDIA



...FROM CHICAGO BOILER

Successful small media milling requires that the product, media and mill be skillfully matched. Usually this doesn't mean the most expensive media...although the lowest cost media are seldom the best answer with most products.

At Chicago Boiler we stock quality silica, glass, zirconium silicate, and steel media in all popular sizes. Call our factory or authorized agents for specific recommendations and prices.

CHICAGO BOILER COMPANY

Established 1891

1965 N. CLYBOURN AVE. • CHICAGO, ILLINOIS 60614
(312) 348-8250 • TWX 910 221-0329 • CABLE: CHIBOCO

Coming Events

FEDERATION MEETINGS

(Oct. 24-26)—62nd Annual Meeting and 49th Paint Industries' Show. Conrad Hilton Hotel, Chicago, IL. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

1985

(May 14-17)—Federation "Spring Week." Seminar on 14th and 15th; Society Officers on 16th; and Board of Directors on 17th. Hilton Hotel, Baltimore, MD. (FSCT, 1315 Walnut St., Philadelphia, PA 19107).

(Oct. 7-9)—63rd Annual Meeting and 50th Paint Industries' Show. Convention Center, St. Louis, MO. (FSCT, 1315 Walnut St., Philadelphia, PA 19107).

1986

(May 13-16)—Federation "Spring Week." Seminar on 13th and 14th; Society Officers on 15th; and Board of Directors on 16th. Sheraton Station Square, Pittsburgh, PA. (FSCT, 1315 Walnut St., Philadelphia, PA 19107).

(Nov. 5-7)—64th Annual Meeting and 51st Paint Industries' Show. World Congress Center, Atlanta, GA. (FSCT, 1315 Walnut St., Philadelphia, PA 19107).

SPECIAL SOCIETY MEETINGS

1985

(Feb. 26-Mar. 1)—Western Coatings Societies Symposium and Show. Disneyland Hotel, Anaheim, CA.

(Mar. 26-28)—Southern Society. Annual Meeting. Atlanta Hilton Hotel, Atlanta, GA. (Salvatore G. Sanfilippo, Reichhold Chemicals, Inc., P.O. Box 1610, Tuscaloosa, AL 35403).

(Apr. 10-12)—Southwestern Paint Convention of Dallas and Houston Societies. Anatole Hotel, Dallas, TX. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(Apr. 25-27)—Pacific Northwest Society for Coatings Technology Symposium. Empress Hotel, Victoria, B.C. (Ottwin Schmidt, Helzer Canada Ltd., 8531 Cullen Crescent, Richmond, B.C., V6Y 2W9 Canada).

1986

(Mar. 25-27)—Southern Society. Annual Meeting. Hilton Hotel, Savannah, GA. (Ronald R. Brown, Union Chemicals Div., P.O. Box 26845, Charlotte, NC 28213).

OTHER ORGANIZATIONS

(July 31-Aug. 2)—"International Symposium on the Analysis and Identification of Polymers." Forensic Science Research and Training Center, Quantico, VA. (K.W. Nimmich, Symposium Coordinator, Forensic Science Research and Training Center, Bldg. 12, Rm. 212, FBI Academy, Quantico, VA 22135).

(July 31-Aug. 2)—"Managing Safety: Techniques That Work for Line Supervisors" Seminar sponsored by Du Pont Co. Buck Hill Falls, PA. (Du Pont Co., Applied Technology, Wilmington, DE 19898).

(Aug. 7-9)—"Process Hazards Management" Seminar sponsored by Du Pont Co. Buck Hill Falls, PA. (Du Pont Co., Applied Technology, Wilmington, DE 19898).

(Aug. 13-17)—Short Course on "Physics and Chemistry of Printing Inks." Davos, Switzerland. (Dr. M.S. El-Aasser, Dept. of

Chemical Engineering, Sinclair Lab #7, Lehigh University, Bethlehem, PA 18015).

(Aug. 20-24)—Short Course on "Advances in Emulsion Polymerization and Latex Technology." Davos, Switzerland. (Dr. Gary Poehlein, School of Chemical Engineering, Georgia Institute of Technology, Atlanta, GA 30332).

(Aug. 21-23)—"Managing Safety: Techniques That Work for the Safety Pro" Seminar sponsored by Du Pont Co. Buck Hill Falls, PA. (Du Pont Co., Applied Technology, Wilmington, DE 19898).

(Aug. 20-24)—Short Course on "Nitride and Carbide Coatings: Deposition Processes and Applications." Soderkoping, Sweden. (Continuing Education Institute—Europe, Rorstorpsvagen 5, S-612 00 Finspang, Sweden).

(Sept. 10-13)—"Radcure '84" Conference on Radiation Curing sponsored by the Association for Finishing Processes of the Society of Manufacturing Engineers. Downtown Marriott, Atlanta, GA. (Donna Theisen, AFP/SME Administrator, Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, MI 48128).

(Sept. 10-14)—"The Basic Composition of Coatings" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Sept. 13-15)—Oil and Colour Chemists Association Australia. 26th Convention. Mandurah, Western Australia. (Grant McManus, P.O. Box 490, Cloverdale, Western Australia 6015).

(Sept. 17-20)—Steel Structures Painting Council Annual Meeting and Symposium on "Maintenance Painting of Industrial Plants." William Penn Hotel, Pittsburgh, PA (Harold Hower, Symposium Coordinator, Steel Structures Painting Council, 4400 Fifth Ave., Pittsburgh, PA 15213).

(Sept. 17-21)—"Physical Testing of Paints & Coatings" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Sept. 22-25)—Canadian Paint and Coatings Association. Annual Convention. Westin Hotel, Winnipeg, Man., Canada. (CPCA, 515 St. Catherine St. W., Montreal, Que. H3B 1B4, Canada).

(Sept. 23-26)—American Oil Chemists' Society Short Course on Fatty Acids. Kings Island, OH. (AOCS, 508 S. Sixth St., Champaign, IL 61820).

(Sept. 23-28)—XVIIth Congress of FATIPEC (Federation of Associations of Technicians in the Paint, Varnish, Lacquer and Printing Ink Industries of Continental Europe). Lugano, Switzerland. (C. Bourgeois, Secretary General, FATIPEC, Maison de la Chimie, 28 Rue St-Dominique, 75 Paris (7), France).

(Oct. 1-5)—Short Course on "Physics and Chemistry of Printing Inks." Lehigh University, Bethlehem, PA (Dr. M.S. El-Aasser, Dept. of Chemical Engineering, Sinclair Lab #7, Lehigh University, Bethlehem, PA 18015).

(Oct. 8-12)—"Advanced Industrial Paint Formulation" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Oct. 8-12)—Spray Painting Seminar. Binks Manufacturing Co., Atlanta, GA. (Binks Manufacturing Co., Training Div., 9201 W. Belmont Ave., Franklin Park, IL 60131).

(Oct. 21-26)—Interfinish '84. Jerusalem, Israel. (Interfinish '84 Secretariat, P.O. Box 29313, 61292 Tel Aviv, Israel).

(Oct. 22-24)—National Paint & Coatings Association 97th Annual Meeting. Palmer House, Chicago, IL. (Karen Bradley, NPCA, 1500 Rhode Island Ave., N.W., Washington, DC 20005).

(Oct. 23-24)—11th International Naval Stores Meeting. Fairmont Hotel, San Francisco, CA.

(Oct. 23-26)—Fall Technical Meeting of the National Coil Coaters Association. Hyatt Regency O'Hare Hotel, Chicago, IL. (NCCA, 1900 Arch St., Philadelphia, PA 19103).

(Nov. 7-8)—4th World Congress on "Coatings Systems for Bridges and Steel Structures." Breckenridge Concourse Hotel, St. Louis, MO. (Cindy Sonewald, University of Missouri-Rolla, Dept. of Chemistry, Rolla, MO 65401).

(Nov. 13-14)—"Innovations in Finishing and Machining for the Wood Industry" Conference, sponsored by the Association for Finishing Processes of the Society of Manufacturing Engineers. Greensboro-High Point Marriott Hotel, Greensboro, NC. (Donna Theisen, AFP/SME Administrator, Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, MI 48128).

(Nov. 16-17)—37th National Decorating Products Show. McCormick Place, Chicago, IL. (NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132).

(Nov. 26-27)—"Job Estimating Workshop for Painting Contractors" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Nov. 28-30)—FINSTRAT '84, Conference and Exposition on Finishing Strategies for the 80's. Marriott Hotel and Anaheim Convention Center, Anaheim, CA. (Association for Finishing Processes of SME, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

(Nov. 28-30)—"Maintenance Painting" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Dec. 3-7)—Spray Painting Seminar. Binks Manufacturing Co., Franklin Park, IL. (Binks Manufacturing Co., Training Div., 9201 W. Belmont Ave., Franklin Park, IL 60131).

(Dec. 4-6)—Plant Engineering and Maintenance Show and Conference/West. Moscone Convention Center, San Francisco,

CA. (Show Manager, Plant Engineering & Maintenance Shows, 999 Summer St., Stamford, CT 06905).

(Dec. 16-21)—1984 International Chemical Congress of Pacific Basin Societies. Honolulu, Hawaii. (PAC CHEM '84, Meetings and Divisional Activities, American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036).

1985

(Mar. 25-27)—"Electrochemical Techniques for Corrosion" Symposium to be held during CORROSION/85, sponsored by the National Association of Corrosion Engineers. Boston, MA. (Symposium Chairman, Robert Baboian, Texas Instruments, Inc., Mail Station 10-13, Attleboro, MA 02703).

(June 11-13)—Eastern Plant Engineering & Maintenance Show and Conference. Georgia World Congress Center, Atlanta, GA. (Show Manager, Plant Engineering & Maintenance Shows, 999 Summer St., Stamford, CT 06905).

(June 26-29)—Oil & Colour Chemists' Association's Biennial Conference. Edinburgh, Scotland. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, HA0 2SF).

(Sept. 2-4)—Federation of Scandinavian Paint and Varnish Technologists. 11th Congress. SAS Hotel Scandinavia, Oslo, Norway. (Paal Ivan, Nodest Industries A/S, Boks 500, N-3001 Drammen, Norway).

1986

(Apr. 14-15)—ASTM Symposium on "Testing of Metallic and Inorganic Coatings," Chicago, IL. (Teri Carroll, ASTM Standards Development Div., 1916 Race St., Philadelphia, PA 19103).

ECLIPSE Dial-O-Matic PANEL SPRAY MACHINES...

...accurately reproduce spray coatings for
precise color control and reliable test results.
Their new design incorporates complete
flexibility with
accuracy. Eclipse will
design and quote
prices for particular
application. Please
contact the factory
for information.





**ECLIPSE
SYSTEMS, INC.**
SUBSIDIARY OF AEROSYSTEMS TECHNOLOGY CORPORATION
P.O. Box E, Cork Hill Road, Franklin, N.J. 07416 • 201/827-7878

Advertisers Index

ANGUS CHEMICAL CO.	21
CHICAGO BOILER CO.	73
CIBA-GEIGY CORP., PIGMENTS DIV.	18-19
CIBA-GEIGY CORP., RESINS DIV.	8-9
DU PONT CO., DIBASIC ESTERS	42
ECLIPSE SYSTEMS, INC.	75
EXXON COMPANY, USA	Cover 3
GENSTAR STONE PRODUCTS CO.	68
HERCULES INCORPORATED	2
MINOLTA CORP.	61
MONSANTO CO.	11, 13
NL CHEMICALS/NL INDUSTRIES, INC.	23
PFIZER, INC., MPM DIV.	16
REICHOLD CHEMICALS, INC.	30
ROHM AND HAAS CO.	4-5, 14-15
SEMICO DIV., M.E. TAYLOR ENGR. INC.	73
SCM PIGMENTS, SCM CORP.	47
SHAMROCK CHEMICALS CORP.	Cover 4
SILBERLINE MANUFACTURING CO.	66
SOUTHERN CLAY PRODUCTS	48
SPARTAN COLOR CORP.	24
UNION CARBIDE CORP.	Cover 2, 1, 53

NOTE: The Advertisers' Index is published for the convenience of our readers as an additional service for our advertisers. The publisher assumes no liability for errors or omissions.

'Humbug' from Hillman

C. Ted Grumbine has apparently developed a fantasy of playing third base for the ASTM Specifications. He has dreamed up a drying time test procedure which is titled, "Drying Time According to Johnny Bench." If there is anyone among our readers not cultured enough to know who Johnny Bench is, I feel obligated to point out that Bench has been distinguished as an outstanding catcher for the Cincinnati Reds (a baseball team). Somehow, I feel that Bench would rather be memorialized in the Baseball Hall of Fame than as the father of a sticky, set-to-touch method. It may just be possible that there is someone who is zany enough to understand the following procedure which must have been conceived in a nightmare and tested in a sandlot. If you have any questions, *call Ted!* He's in the book.

Drying Time According to Johnny Bench

SCOPE	This method covers the procedure for determining the "set-to-baseball" stage of dry for aerosol-applied organic finishes.
APPARATUS	1. major league baseball player ¹ 2. major league approved baseball 3. Carrara glass, aluminum or steel panels, or other dimensionally stable substrate, ² as specified.
TEST CONDITIONS	Conduct all drying tests in (A) a well-ventilated room or chamber, free from direct drafts (or free-agent drafts), dusts, products of combustion, laboratory fumes, and under diffused light, at a temperature of 23+/-2°C and a relative humidity of 50 +/-5%, or (B) the backyard of a typical suburban home on a sunny day, whichever is more convenient. When using Method (B), two commercially available products must be used as controls. The ambient conditions must be such that (1) a sprayed film of Brand "K" is set-to-baseball in not greater than 12 minutes, and (2) the set-to-baseball stage of dry for Brand "R" is greater than 2 hours.
PREPARATION OF TEST SPECIMENS	Prepare a specimen for test by applying the test material (and controls, as necessary) to the specified panel according to the manufacturer's directions.

PROCEDURE Place the test panel in a horizontal position at a height such that when the baseball player grasps the baseball in the palm of the hand and the baseball is contacted to the specimen, the arm of the baseball player is in a vertical line from the wrist to the shoulder. Operators should be cautioned to insure that a cowhide area of the baseball, not a stitched area, is contacted to the film. Instruct the baseball player to bear down on the baseball with the palm of the hand, exerting the maximum pressure of the arm, at the same time turning the wrist through an angle of 90° in the plane of the film. The film is considered set-to-baseball when none of it adheres to the baseball.

REPORT Report the set-to-baseball drying time to the nearest 0.1 minute and broadcast this figure during prime-time on national TV *ad infinitum*.

COMPENSATION For services rendered, compensate the baseball player. The following formula shall be used in determining adequate compensation:

$$C = em^2$$

where C = compensation

e = the baseball player's annual salary

m = the annual advertising budget of the supplier company

DISPUTE In the event of disagreement of test results between purchaser and supplier, ask Bowie Kuhn what to do.

¹Catchers from Cincinnati with a batting average over .300 have been found to be suitable.

²Rusty old metal lawn furniture, available from your next-door neighbor, has been found to be suitable.

—Herb Hillman
Humbug's Nest
P.O. Box 135
Whitingham, VT 05361



ISOPAR[®] Solvents: good surface wetting through low surface tension.

ISOPAR solvents offer you lower surface tension than you can expect from typical hydrocarbon solvents. That provides better wetting of substrates by coatings, inks, adhesives and other types of resins. It also means you'll get improved dispersibility of pigments and reduced foaming during the processing and application of water-based products (without side effects).

ISOPAR solvents also have extremely low odor and consistent high purity.

So, if you're already using a different hydrocarbon solvent, try blending it with an ISOPAR grade,

instead. Tests have shown that ISOPAR solvents can reduce the high surface tension, characteristic of other hydrocarbon solvents, while retaining the solubility required for many resinous components.

ISOPAR may be just the solvent you've been looking for if surface tension and surface wetting are important in your formulations.

For more information, mail our coupon, today. It may well bring the solution to your formulation problems.

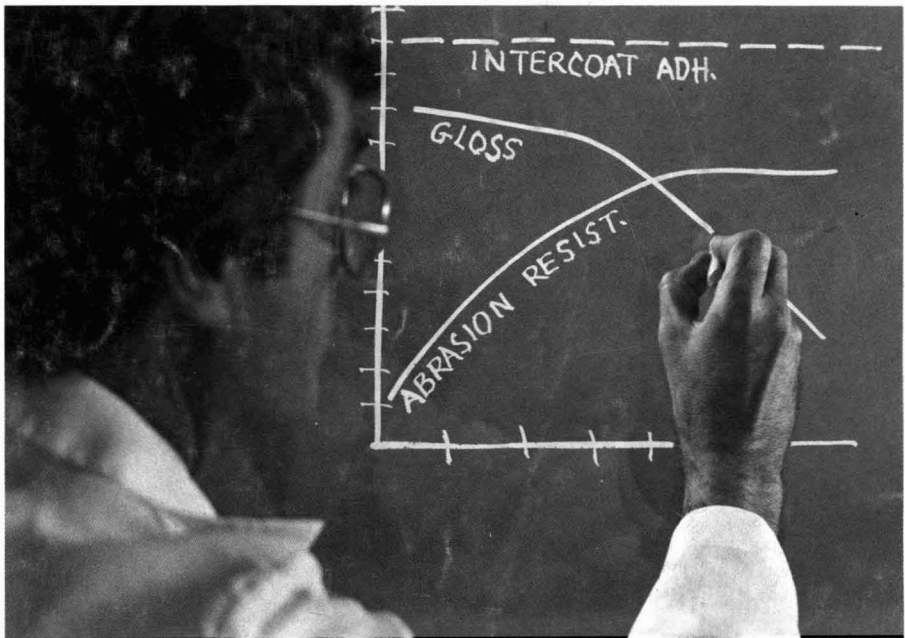
**Quality
you can
count on.**



Name _____
Title _____
Company _____
Address _____
City _____
State _____ Zip _____
Phone _____

- Send more information on ISOPAR solvents.
 Send a sample in this distillation range _____
 Have your representative call me.

Mail to: Exxon Company, U.S.A.
Room 2323KK, P.O. Box 2180
Houston, Texas 77001



SHAMROCK STIR-IN POWDERS: mar/abrasion resistance without sacrificing intercoat adhesion

This small, but critical, ingredient may well be the most important component used in your formulation. Shamrock stir-in powders integrate mar and abrasion resistance, lubricity, slip, flatting control, anti-blocking qualities, gloss retention, recoatability, and intercoat adhesion. They work in a wide range of systems for brush, spray, dip, powder coating, curtain coating, roller coating and other application techniques. Shamrock technical personnel will work with you to determine your grind and solubility requirements. Ask for literature and samples.

INNOVATION IN POWDER TECHNOLOGY

SHAMROCK
CHEMICALS CORPORATION

Foot of Pacific St., Newark, N.J. 07114, Phone (201) 242-2999