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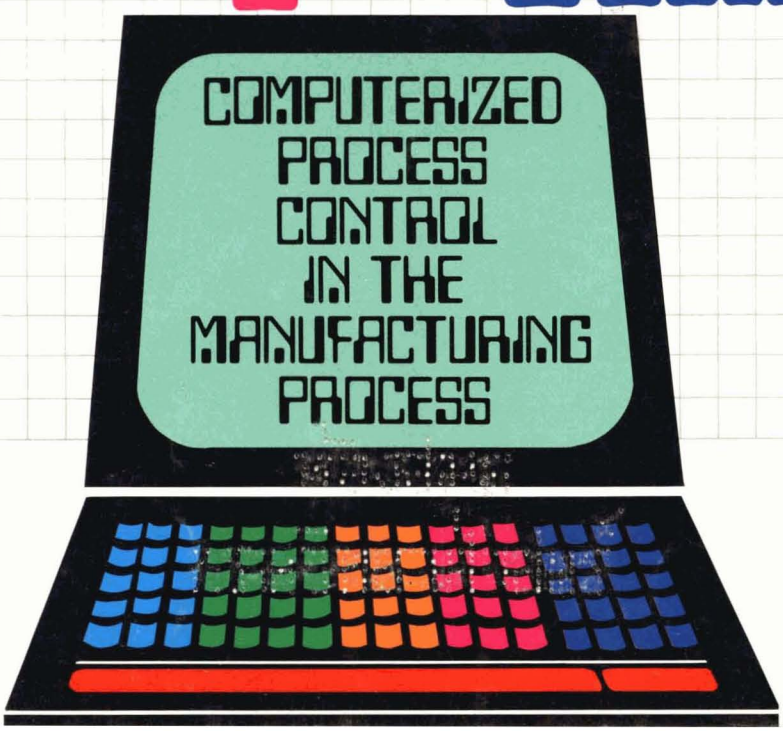
NOVEMBER 1983

jct JOURNAL OF COATINGS TECHNOLOGY

Inventory Batch Agitate Temperature Mix Recipe Time



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Let it rain. Let it snow. Let the four winds blow. It doesn't matter. This car is protected.

That's because its sheet metal was factory primed with a flexible, corrosion-resistant coating made from UCAR Phenoxy Resins.

These high-performance thermoplastic resins not only offer corrosion protection, but also provide exceptional cohesive strength, good impact resistance, and excellent pigment binding ability. Plus, their outstanding compatibility with a wide variety of other coatings resins, such as phenolics, epoxies, and polyesters, permits an even greater range of achievable performance properties.

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NOVEMBER 1983

jct JOURNAL OF COATINGS TECHNOLOGY

VOLUME 55 NUMBER 706

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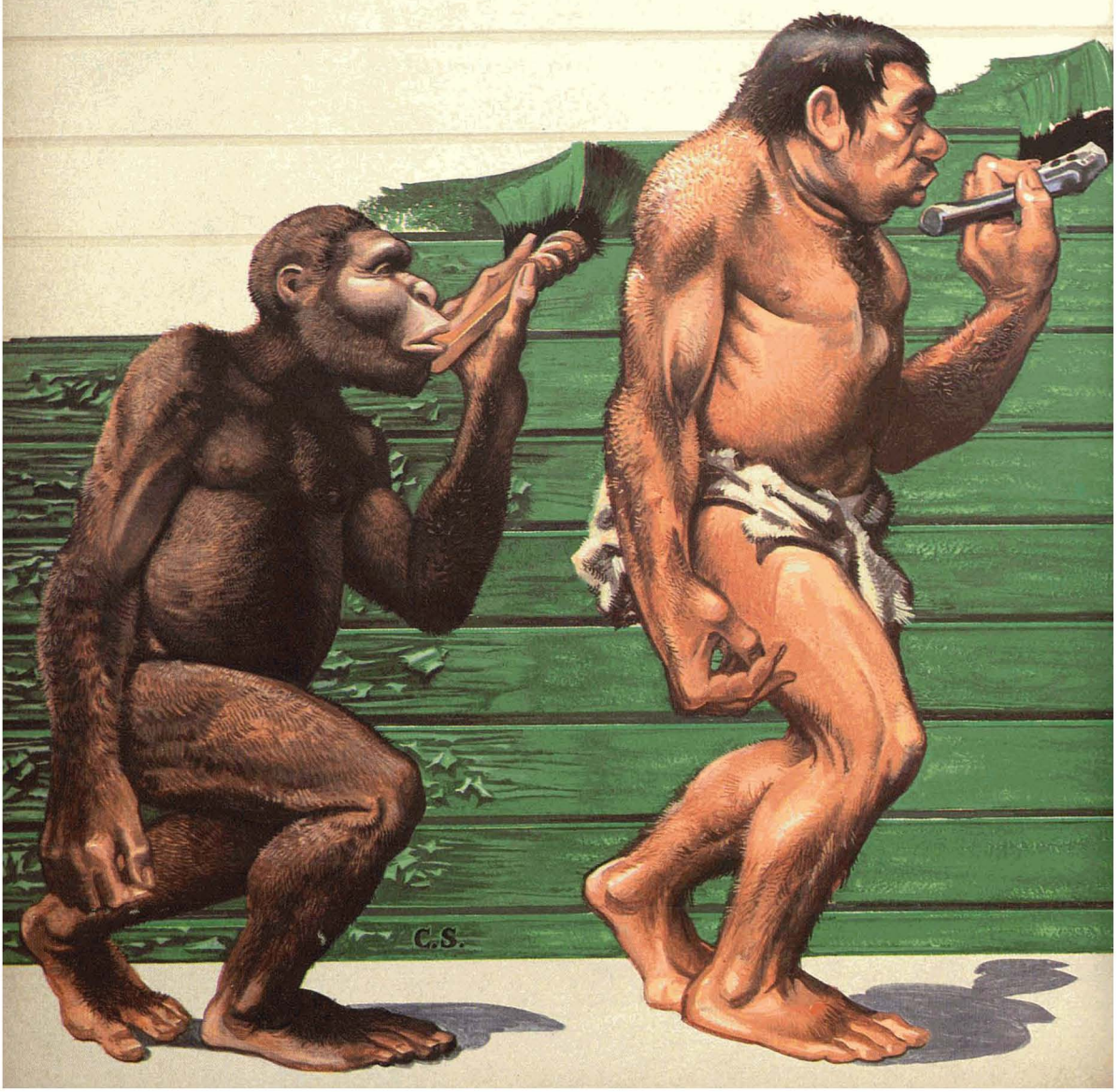

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The JOURNAL OF COATINGS TECHNOLOGY has first rights to the publication of papers presented at the Annual Meeting of the Federation and at local and regional meetings of the Federation's Constituent Societies.

A Guide for Authors is published in each January issue.

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

Comment

The Challenge

Everywhere we turn there is another challenge for each of us to face—a mountain to scale, another problem to solve, a new service to provide, and a promise to keep.

Those of us who have been fortunate to move through the Federation Chairs soon come to grips with the demands that accompany the Presidency. The responsibilities seem sky-high and the time constraints more than the clock will endure. Then—out of the blue comes the revelation that 61 other Presidents experienced the same butterflies and managed to fill their years with success and accomplishment.

Their secret and my secret: within our great Federation is the finest collection of talent and volunteer spirit that can be found anywhere.

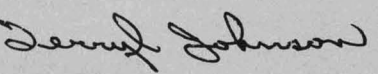
You start with an Executive Committee, then a Board of Directors. Behind them are the Chairmen and members of committees. Moving out to the grass roots, you have 104 officers, more Boards of Directors, and committees.

That's a lot of people. But working and pulling together as they have in the past is what makes the job of Federation President exciting, rewarding, and enjoyable.

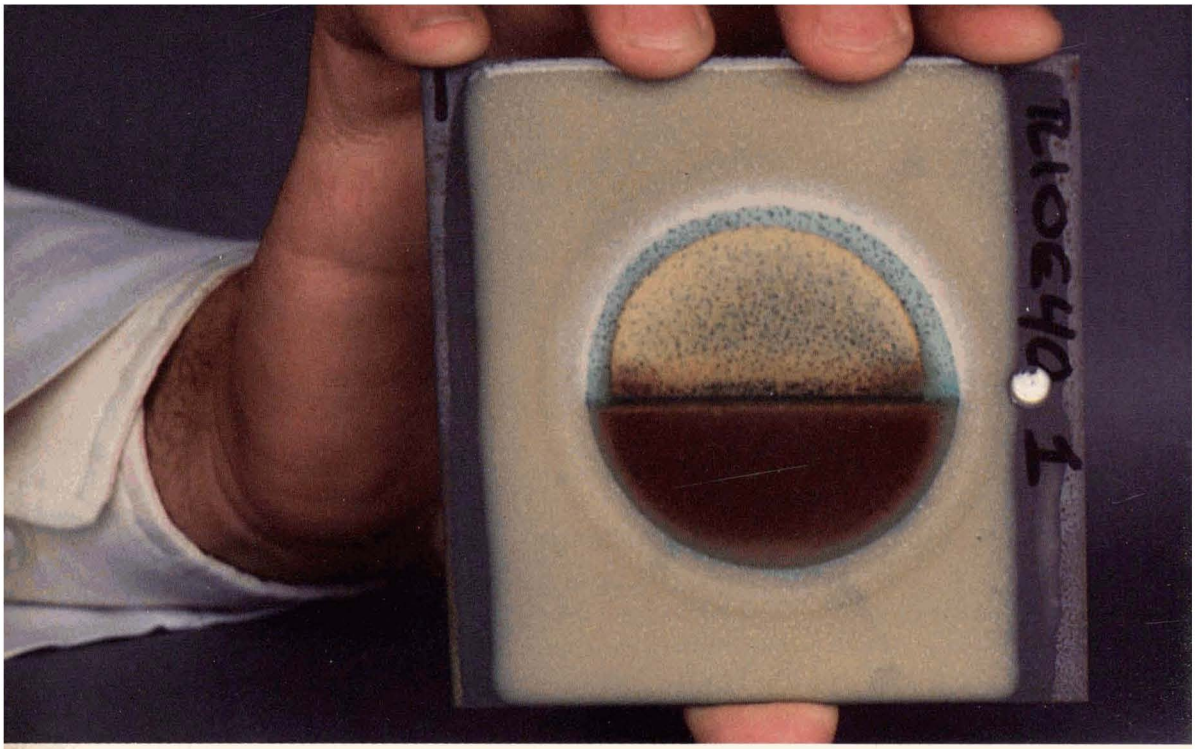
I look forward to my association with Federation members during the coming year and I know that each one of us will benefit from the time contributed to Society and Federation activities.

I, and other officers, will visit many of the Societies within the next several months, along with members of the staff. We look forward to seeing old friends and making new ones.

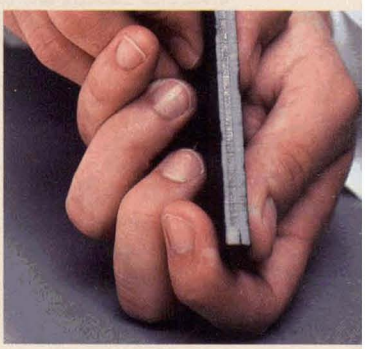
Thank you for the privilege of serving as your next President.



Terryl Johnson
Federation President, 1983–84



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

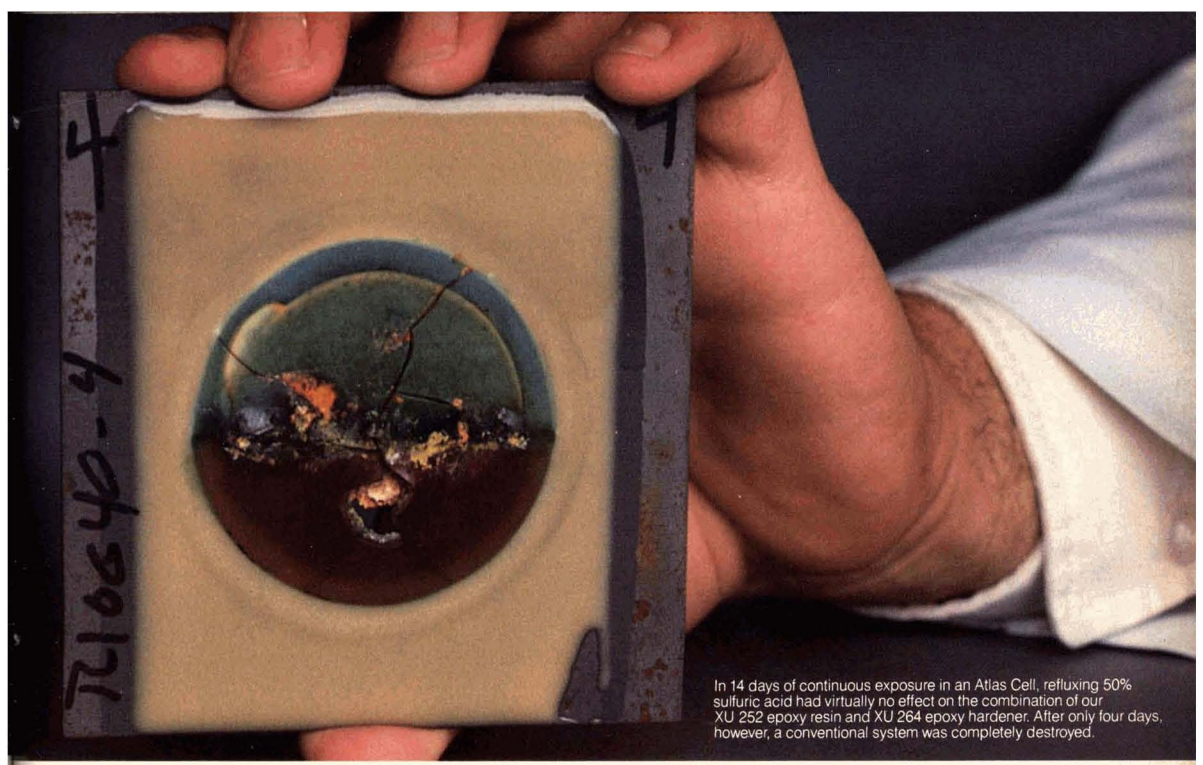


Encapsulated in our XU 252 and XU 264 system, this strip of steel was immersed in a 50% sulfuric acid bath for two hours at room temperature then, without rinsing, put into a 350° oven for 30 minutes. This was followed by quenching in sulfuric acid. After 10 such cycles, there was slight surface charring—but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

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 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.

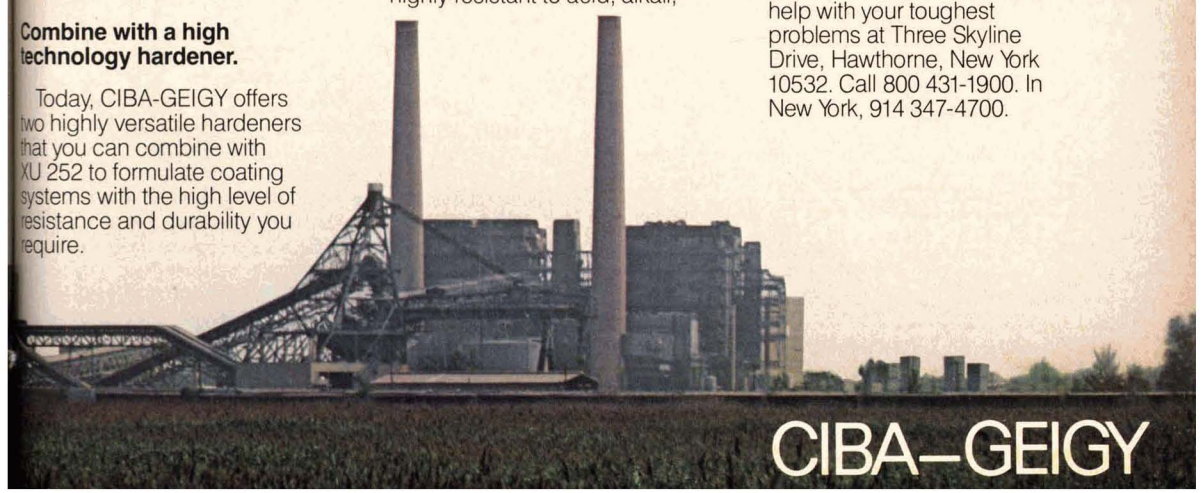
Today, CIBA-GEIGY offers two highly versatile hardeners that you can combine with XU 252 to formulate coating systems with the high level of resistance and durability you require.

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.



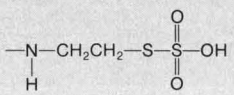
CIBA–GEIGY

Abstracts of Papers in This Issue

BUNTE SALTS AS CROSSLINKING AGENTS IN THERMOSETTING WATER-BORNE POLYMERS—S.F. Thames

Journal of Coatings Technology, 55, No. 706, 33 (Nov. 1983)

Substituted aminoethanethiosulfuric acids, or bunte salts (I),



(I)

have been incorporated into the structure of preformed thermoplastic polymers soluble only, prior to bunte salt incorporation, in organic solvents. However, inclusion of the bunte salt group as part of the polymer structure renders the polymer water soluble. It likewise provides a moiety capable of thermal disproportionation and subsequent crosslinking.

It has been shown previously that the S-S bond of the bunte salt is labile toward ionizing radiation, acid hydrolysis, reducing agents, and oxidizing agents. Thus, the availability of bunte salt functionality as part of a polymer structure provides crosslinking capability, as well as rendering the polymer water sensitive prior to curing and water insensitive subsequent to curing. It has been shown that the bunte salt moiety will crosslink polymers at temperatures as low as 123°C. Much of the characterization of the polymers synthesized during this research effort is discussed, as well as mechanical properties of the thermoset species.

Papers to Be Featured in the December Issue

"Accomplishments of the Mildew Consortium"—Charles C. Yeager, Registration Consulting Associates

"Elements of a Successful Research Project: The Development of an Opaque Polymer"—Richard E. Harren, Rohm and Haas Co.

"Model for the Packing of Pigment Particles in Paint Films"—R. Castells, et al., CIDEPINT

"Surface Characteristics that Control the Phosphatability of Cold-Rolled Steel Sheet—S. Maeda, Nippon Steel Corp.

"Visual Color Technology Development in the Coatings Industry"—James T. DeGroff, Applied Color Systems, Inc.

"What Did the PRI Questionnaire Tell Us?"—Royal A. Brown, FSCT Technical Advisor

COPOLYMERS OF POLYSTYRENE GLYCOL AND LINSEED OIL MODIFIED GLYCERYL ADIPATE FOR SURFACE COATINGS—S. Agarwala

Journal of Coatings Technology, 55, No. 706, 43 (Nov. 1983)

The preparation of polyester coatings of the alkyd type using adipic acid, glycerol, polystyrene glycol, and linseed oil is reported in which phthalic anhydride is completely replaced by adipic acid. Maximum amount of polystyrene glycol compatible during the synthesis of copolymer was investigated. In addition, other samples having lower amounts of polystyrene glycol were also prepared. A control sample of phthalic alkyd was prepared. Film properties of the xylene solution of copolymers and the control sample were evaluated for drying characteristics, flexibility and adhesion, scratch hardness, and resistance to water, acid, alkali, and solvent. It was found that copolymers had better physical and chemical properties as compared to the control. The results revealed that phthalic anhydride can be conveniently replaced by adipic acid and polystyrene glycol with advantages of incorporating polystyrene moiety which also contributes the benzene rings necessary for the required hardness in these copolymers.

COMPUTERIZED PROCESS CONTROL IN THE MANUFACTURING PROCESS—J.P. Kennedy

Journal of Coatings Technology, 55, No. 706, 51 (Nov. 1983)

All formula based manufacturing processes have potentially very large payouts from consistency, quality, throughput, and elimination of errors. Proven techniques for automated production can generate large returns. This paper deals with the practical task of reducing this technology to practice and profits; primarily developing a reasonable definition of a project that fits the support capabilities and budget of small companies.

The inside story on tough long-lasting powder coatings.

2″ pipe coated inside with powder coating containing Modaflow®

Modaflow® is a dependable way to help improve the durability of your coatings.

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Developed by Monsanto, the pioneer in acrylic flow aid technology, liquid Modaflow and Modaflow Powder II help promote flow and total coverage. And with Modaflow, coatings adhere better. So you get the kind of coverage that helps inhibit rust and corrosion, even in salty, acidic, wet environments.

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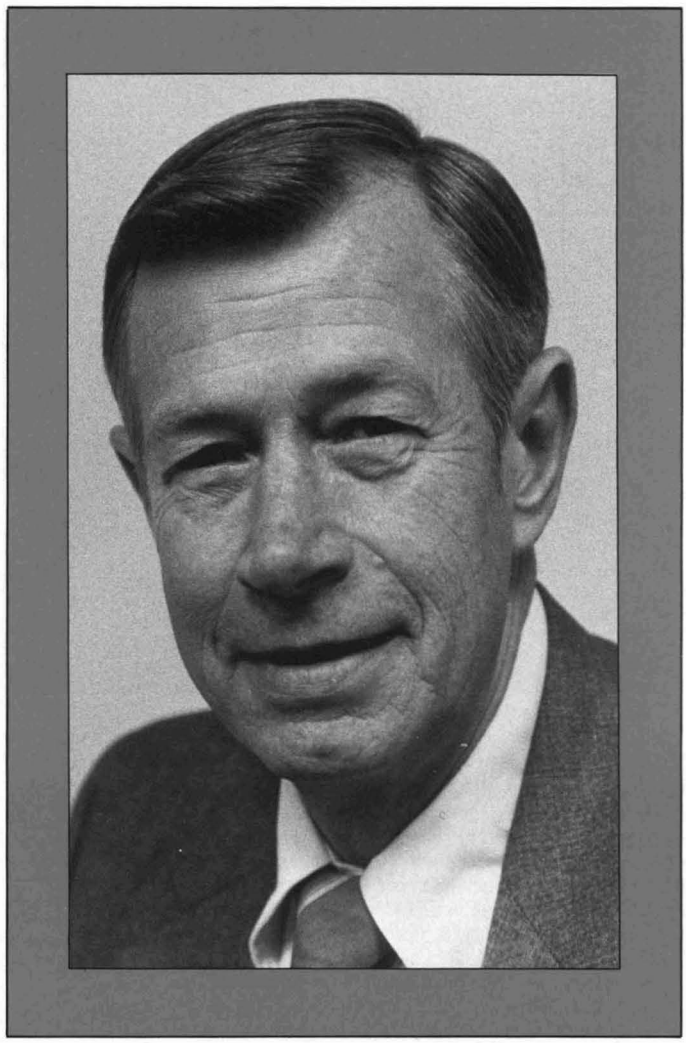
Federation News

Terryl F. Johnson, of Kansas City Society Becomes Sixty-Second Federation President

Terryl F. Johnson, of Cook Paint & Varnish Co., Kansas City, MO, became the 62nd President of the Federation of Societies for Coatings Technology on October 14 at the Federation's Annual Meeting in Montreal, Quebec.

Joseph A. Bauer, of Porter Paint Co., Louisville, KY, was named President-Elect; and William Mirick, of Battelle Columbus Laboratories, Columbus, OH, was elected Treasurer.



President Johnson

Mr. Johnson is a Past-President of both the Kansas City Society and Kansas City PCA. He was Society Representative to the Federation Board of Directors for eight years. He served as a member of the Federation Executive Committee and Chairman of the Materials Marketing Associates Awards Committee.

Mr. Johnson has been with Cook since 1947. He is a graduate of the University of Missouri.

President-Elect Bauer

Mr. Bauer is a Past-President of the Louisville Society and was the Society Representative to the Federation Board of Directors for 10 years. At the Federation level, Mr. Bauer has served on the Executive, Nominating, and Program Committees. He joined Porter Paint in 1952 and is a graduate of the University of Louisville.

Treasurer Mirick

Mr. Mirick is a Past-President of the C-D-I-C Society and has served as the Society Representative to the Federation Board since 1975. He is a past member of the Federation Executive Committee, and has served as Chairman of the Annual Meeting Program Awards Committee. A researcher at Battelle, he joined the Laboratories in 1956. He attended Ohio State University.

J.A. Bauer

W. Mirick

Chicago Is 1984 Site Of FSCT Annual Meeting

The 1984 Annual Meeting and Paint Industries' Show of the Federation of Societies for Coatings Technology will be held at the Conrad Hilton Hotel, Chicago, IL, on October 24-26.

Dr. Darlene Brezinski, of DeSoto, Inc., Des Plaines, IL, will be the Program Chairman. The Host Committee will be headed by Richard M. Hille, of General Paint & Chemical Co., Cary, IL.

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.

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President Johnson Announces Committee Chairmen for 1983–84

Chairmen of the 28 committees of the Federation of Societies for Coatings Technology for 1983–84 have been announced by President Terryl F. Johnson. A complete roster of all committees will be published in the 1984 Year Book.

An asterisk (*) indicates re-appointment for 1984.

A.F. VOSS/AMERICAN PAINT & COATINGS JOURNAL AWARDS—Carl Knauss, Kent State University, Kent, OH.*

BRUNING AWARD—Ruth Johnston-Feller, Pittsburgh, PA.*

BY-LAWS—Fred Schwab, Coatings Research Group, Cleveland, OH.*

CORROSION—Thomas Ginsberg, Union Carbide Corp., Bound Brook, NJ.

DEFINITIONS—Stanley LeSota, Rohm and Haas Co., Philadelphia, PA.*

EDUCATION—James Hoeck, Reliance Universal, Inc., Louisville, KY.*

ENVIRONMENTAL CONTROL—Sidney Rubin, Empire State Varnish Co., Brooklyn, NY.*

FINANCE—A. Clarke Boyce, Nacan Products Ltd., Toronto, Ont., Canada.

HECKEL AWARD—Thomas J. Miranda, Whirlpool Corp., Benton Harbor, MI.

HOST (Annual Meeting)—Richard M. Hille, General Paint & Chemical Co., Cary, IL.

INTER-SOCIETY COLOR COUNCIL—Jacqueline Welker, PPG Industries, Inc., Springdale, PA.*

INVESTMENT—Neil Estrada, Los Altos Hills, CA.*

LIAISON—David Lovegrove, Carr's Paints Ltd., Birmingham, England.

MANUFACTURING—Richard Max, Synkote Paint Co., Elmwood Park, NJ.*

MATTIELLO LECTURE—Joseph A. Vasta, E.I. du Pont de Nemours & Co., Inc., Wilmington, DE.

MEMBERSHIP—R.H. Stevenson, Tenneco Chemical Canada Ltd., Bramalea, Ont., Canada.*

MEMORIAL—Elder Larson, Houston, TX.*

MMA AWARDS—Victor M. Willis, Sherwin-Williams Co., Chicago, IL.

NOMINATING—A. Clarke Boyce.

PAINT INDUSTRIES' SHOW—Deryk R. Pawsey, Rohm and Haas Canada Ltd., Vancouver, B.C.*

PROGRAM—Darlene Brezinski, DeSoto, Inc., Des Plaines, IL. Vice-Chairman—Joseph A. Vasta.

PROGRAM AWARDS—Take Anagnostou, Wyandotte Paint Products, Inc., Troy, MI.*

PUBLICATIONS—Thomas J. Miranda.*

ROON AWARDS—Joseph A. Vasta.

SPECIFICATIONS—Lothar Sander, Amchem Products Co., Philadelphia, PA.*

TECHNICAL ADVISORY—Saul Spindel, D/L Laboratories, New York, NY.

TECHNICAL INFORMATION SYSTEMS—Helen Skowronska, Cleveland, OH.*

TRIGG AWARDS—James Albright, Jr., Lilly Co., High Point, NC.

Delegates to Other Organizations

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—Thomas Ginsberg.*

NATIONAL PAINT & COATINGS ASSOCIATION, SCIENTIFIC COMMITTEE—Colin Penny, Hampton Paint Mfg. Co., Hampton, VA.*

STEEL STRUCTURES PAINTING COUNCIL—Sid Levinson, D/L Laboratories, New York, NY.*

NATIONAL PAINT & COATINGS ASSOCIATION AND GOVERNMENT AGENCIES (ENVIRONMENTAL CONTROL)—Sidney Rubin.*

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY—David Lovegrove.

FSCT to Publish New Series on Coatings Technology

Plans for development of a completely new Series on Coatings Technology have been announced by the Federation of Societies for Coatings Technology.

The current Series of 27 booklets covers a wide variety of coatings topics and serves as a valuable teaching and training resource. But the many changes which have taken place in the industry since the first of the booklets was published in 1964 underscore the need for revising the Series to reflect current technology, as well as more uniformity in content, format, and treatment of the various subjects.

To address this need, an Advisory Board has been appointed to develop a new set of booklets, select authors, review submitted drafts, and provide for ongoing revision and updating.

Dr. Thomas Miranda (Whirlpool Corp., Benton Harbor, MI) and Dr. Darlene Brezinski (DeSoto, Inc., Des Plaines, IL) will serve as Editors of the new Series. Dr. Miranda, who chairs the Advisory Board, is Chairman of the Federation's Publications Committee and Technical Editor of the *Journal of Coatings Technology*. Dr. Brezinski is a member of the Publications Committee, the JCT Editorial Review Board, and the Series Advisory Board.

The Board is compiling a list of titles and basic outlines for the new booklets. Authors, who will be paid an honorarium, are being solicited for the various topics, with the aim of developing the entire collection of booklets concurrently.

Work on the new Series is expected to get underway shortly, but no date has been set for availability of the new booklets.

Serving on the Advisory Board with Drs. Miranda and Brezinski are: Dr. Loren Hill (Monsanto Corp., Indian Orchard, MA); Dr. Joseph Koleske (Union Carbide Corp., South Charleston, WV); Hugh Lowrey (Perry & Derrick Co., Inc., Cincinnati, OH); Stan LeSota (Rohm and Haas Co., Spring House, PA); Dr. Percy Pierce (PPG Industries, Inc., Allison Park, PA); and Dr. Joseph Vasta (E. I. duPont de Nemours & Co., Inc., Wilmington, DE).

FSCT Announces Staff Promotions

Two promotions on the staff of the Federation of Societies for Coatings Technology have been announced by Frank J. Borrelle, Executive Vice-President.

Lorraine A. Ledford has been appointed Manager of Advertising Services, all publications. She was formerly Special Publications Editor. Ms. Ledford, a graduate of the University of Tennessee, joined the staff in May 1977.

Jane Marie Paluda is the new Managing Editor of the *Journal of Coatings Technology*. She moves up from Associate Editor. Ms. Paluda is a graduate of Moravian College and joined the staff in November 1980.

*Manville Celite® The most cost-effective and efficient flatting filler you can use.

Manville has been an international leader in developing and providing functional flatting fillers for paint for 50 years. Today, Celite diatomite fillers are the industry's most cost effective because of their unique combination of high flatting efficiency and low cost-per-gallon. Check the chart to see just how well Celite outperforms other common paint fillers.

Celite provides high flatting efficiency because of the structure of its particles. Their irregular shapes disrupt specular reflection, resulting in uniformly reduced gloss and sheen, even over non-uniform surfaces. Celite provides luster control to any desired level.

In addition, Celite functional fillers offer increased toughness and durability; added "tooth" for better adhesion of subsequent coats; and improved sanding and touch-up properties.

Take advantage of Manville's unparalleled expertise in filler technology. For product samples and more information about what Celite fillers can do for you, write Manville, Filtration and Minerals, P.O. Box 5108, Denver, CO 80217. Or call (303) 978-2656.

Filler	Lbs/ Gallon*	Cost/ Gallon Index**	Hegman	60° Gloss	85° Sheen
Celite 499	1.0	100	4	12	24
Celite White Mist®	1.0	190	5	15	32
Hydrogel	0.9	400	5½	16	30
Precipitated Silica	0.9	290	5½	20	34
Calcium Carbonate	3.0	70	6	18	55
Talc, Micronized	2.5	160	6	20	52
Amorphous Silica	2.75	130	6	28	48
Delaminated Clay	2.75	120	5½	26	58
Calcined Clay	2.5	150	5½	19	50

* Addition is to high gloss white alkyd enamel mixed 5 minutes in disc disperser. Initial enamel reading: 89° gloss, 94° sheen.

** Index uses Celite 499 as base = 100. Ratios based on 10,000 lb. shipments FOB NY, December, 1982.

Manville

Filtration Procedures Used In the Resin Manufacturing Industry

Manufacturing Committee
Kansas City Society for Coatings Technology

Larry Kytasaari, Chairman
John Bradley
J. Chris Cooper

The Kansas City Society Manufacturing Committee recently conducted a survey to determine filtration procedures used in resin manufacture. The project was undertaken to collect data which it was felt would be of value in helping firms determine the best filtration methods for their particular operation.

A filtration questionnaire was sent out to 240 manufacturers of resins. Information was requested on the following:

(1) Type of resin manufactured at your plant.

(2) Types of filtering devices used at your plant.

(3) How would you rate each device used as to the clarity of the final product?

(4) Which filter is used for each type of resin?

(5) Is more than one filtering device used at a time (as in series)?

(6) What set-up is used on the block press (plate and frame)?

(7) Micron size of cartridge filter being used.

(8) Micron size of bag filter being used.

The results of the filtration questionnaire are summarized herewith (approximately 30 manufacturers responded).

Types of resins manufactured by the respondees break down as follows:

Acrylics	12.1%
Alkyds	28.8%
Emulsions	15.2%
Epoxies	12.1%
Melamine or urea	6.1%
Unsaturated polyesters	7.6%
Urethanes	10.6%
Others	7.6%

Definite trends could be determined within each product category as to the preferred method of filtration.

Acrylics

Bag	60%
Block press	30%
Cartridge	10%

Alkyds

Bag	29.1%
Block press	41.7%
Cartridge	12.5%
Sock	8.3%
Centrifuge	4.2%
Other	4.2%

Emulsions

Bag	37.5%
Vibrating screen	25.0%
Cartridge	18.8%
Sock	18.8%

Melamine or urea

Block press	50.0%
Cartridge	25.0%
Bag	25.0%

Epoxies

Bag	44.4%
Block press	33.3%
Cartridge	11.1%
Sock	11.1%

Urethanes

Bag	50.0%
Block press	37.5%
Cartridge	12.5%

Unsaturated polyesters

Bag	42.9%
Block press	14.3%
Centrifuge	14.3%
Cartridge	14.3%
Sock	14.3%

The types of filtration devices used by the respondees are summarized below:

Bag	28.8%
Block press	22.0%
Cartridge	18.6%
Sock	11.9%
Vibrating screen	11.9%
Centrifuge	3.4%
Other	3.4%

The block press, cartridge, and bag filtration methods accounted for approximately 70% of filtration procedures used. Within this group, the block press was rated superior for clarity and filter rate, while the cartridge was rated superior for lack of contamination. A summary of the average values rated for each method of filtration for clarity, filter rate, and lack of contamination is shown in *Table* 1.

In reference to the use of several filtration devices in a series, 64% did not filter in a series, and 34% did. In

(Continued on page 77)

Table 1—Average Values of Filtration for Clarity, Filter Rate, and Lack of Contamination[a]

	Clarity	Filter Rate	Lack of Contamination
Block press	4.4	3.7	3.6
Centrifuge[b]	4.0	2.5	3.5
Cartridge	4.1	3.3	3.8
Bag	3.1	3.6	3.5
Sock	1.8	3.2	2.0
Vibrating screen	2.9	4.1	3.6

(a) Values are from 1 to 5, with 5 being considered best and 1 worst.
(b) Values for the centrifuge represent only two responses and should be considered accordingly.

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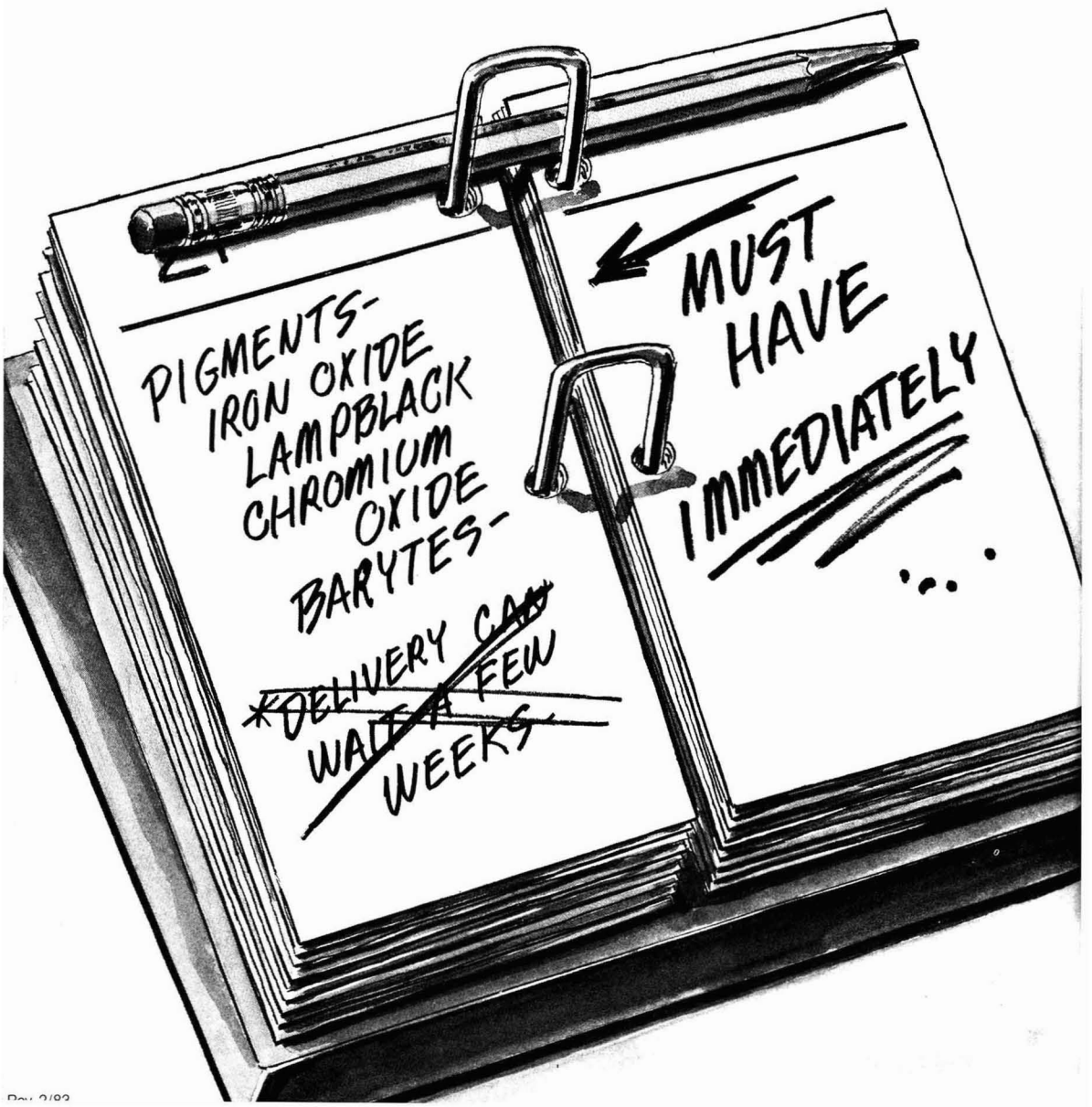

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Government and Industry

ASTM to Develop Voluntary Standard Test Methods For Paint Application Tools

In order to develop criteria for state and institutional purchasing agents to follow when buying paint rollers and brushes, a new subcommittee has been formed within ASTM Committee D-1 on Paint and Related Coatings and Materials.

Subcommittee D01.61 on Paint Application Tools will hold a planning meeting on December 11–14, 1983 at the Sheraton Bal Harbour in Bal Harbour, FL. All interested parties are encouraged to participate.

Two task groups have been organized within the subcommittee: Paint Brushes and Paint Rollers.

According to William V. Moseley, of the State of Virginia, Department of Highways and Transportation and Chairman of the Paint Brush Task Group, no standard purchasing criteria currently exists for paint brushes. "It is hoped that a rational grading system of some type will be developed for brushes so that purchasers can choose the right quality for their purpose," he said.

One of the first steps in developing criteria for purchasing, according to John F. Price, of EZ Paintr Corp., Milwaukee, WI, and Chairman of the Paint Roller Task Group, is to determine the necessary performance and quality tests for the criteria itself.

For more information, or to participate on Subcommittee D01.61 on Paint Application Tools, contact the Subcommittee Chairman, Frederick B. Burns, EZ Paintr Corp., 4051 South Iowa Ave., Milwaukee, WI 53207, 414-481-4500; or ASTM Staff Manager, Philip Lively, ASTM Standards Development Div., 1916 Race St., Philadelphia, PA 19103, 215-299-5481.

Rust-Oleum Establishes Mexican Operations

Rust-Oleum Corp. has established a coatings manufacturing facility in Tampico, Mexico.

Rust-Oleum de Mexico, S.A., a joint venture involving Rust-Oleum Corp. and a group of prominent Mexican businessmen, will manufacture industrial coating materials, including alkyds, acrylics, urethanes, coal tars, epoxies, zincs, and vinyls. The facility will provide a wide range of high-quality coatings capable of meeting the needs of the Mexican industrial coatings market.

The company is headquartered in Mexico City, with warehouses and sales offices in Coatzacoalcos, Salina Cruz, Tampico, and Mexico City. Additional branches are expected to open in 1984.

Kalcor Coatings Acquires Midland Dexter Unit

Kalcor Coatings Co., Willoughby, OH, has acquired the Midland Division of the Dexter Corp. in Cleveland, OH. A producer of high performance industrial coatings as well as architectural paints, maintenance coatings, and certified specification paints, Kalcor purchased the plant facilities, equipment, and customer lists from the Dexter Corp.

"In addition, we have acquired formulas, transition assistance plus key laboratory and sales personnel," said Newton Zucker, President of Kalcor. All of the acquired company's operations have been shifted to the Kalcor plant at 37721 Stevens Blvd.

Kalcor will continue to purchase special resins from Midland Dexter to maintain the integrity of the product lines it acquires. Under the sales agreement, Midland Dexter will continue to transfer technical data and product information.

Pratt & Lambert Acquires Body Brothers of Ohio

Pratt & Lambert, Inc., Buffalo, NY, has acquired Body Brothers, Inc., Bedford, OH.

Body Brothers, a manufacturer of industrial coatings, has become a branch of the Pratt & Lambert Industrial Coatings Group. The new unit is responsible for production of chemical coatings once manufactured at one of the acquiring company's plants in Buffalo.

R.W. Body, Chairman of Body Brothers, has become a Consultant, and J.D. Harris, President, has been named General Manager of the Cleveland plant.

Mooney Chemicals Purchases Ferro Paint Drier Business

Ferro Corp. and Mooney Chemicals, Inc., both of Cleveland, OH, have announced that Mooney has purchased the U.S. and Canadian paint drier business, technology, trademarks and customer lists, plus related metal carboxylate chemical products from Ferro's Chemical Div., Bedford, OH.

Included in the sale are Ferro's synthetic high efficiency driers (HED), naphthenate and Catalox® octoate driers, Viscotrol-A® thixotropic thickener, and Skinfoil® KE anti-skinning agent. The sale does not include manufacturing facilities or equipment, or any of Ferro's stabilizer or tin catalyst products.

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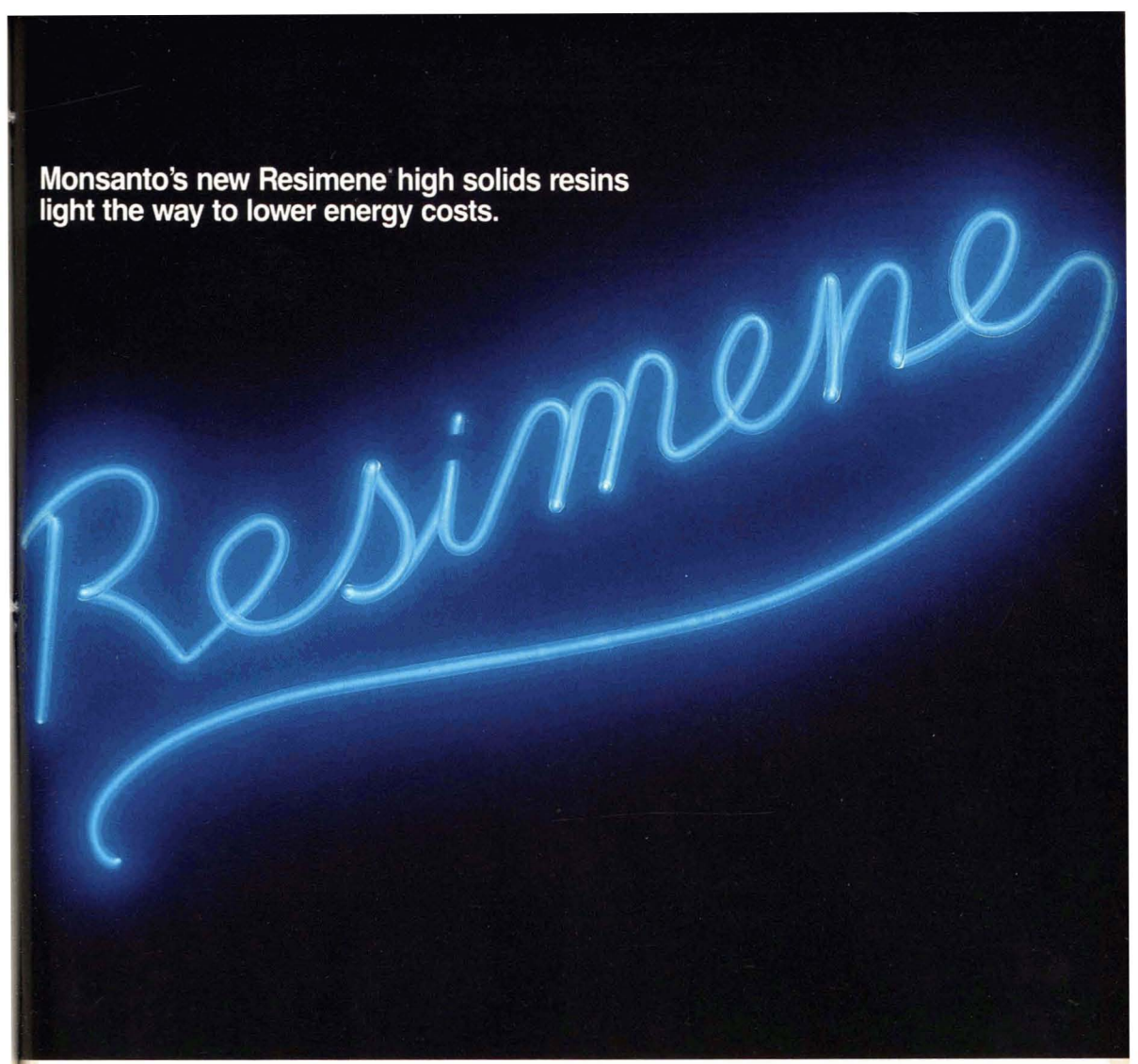

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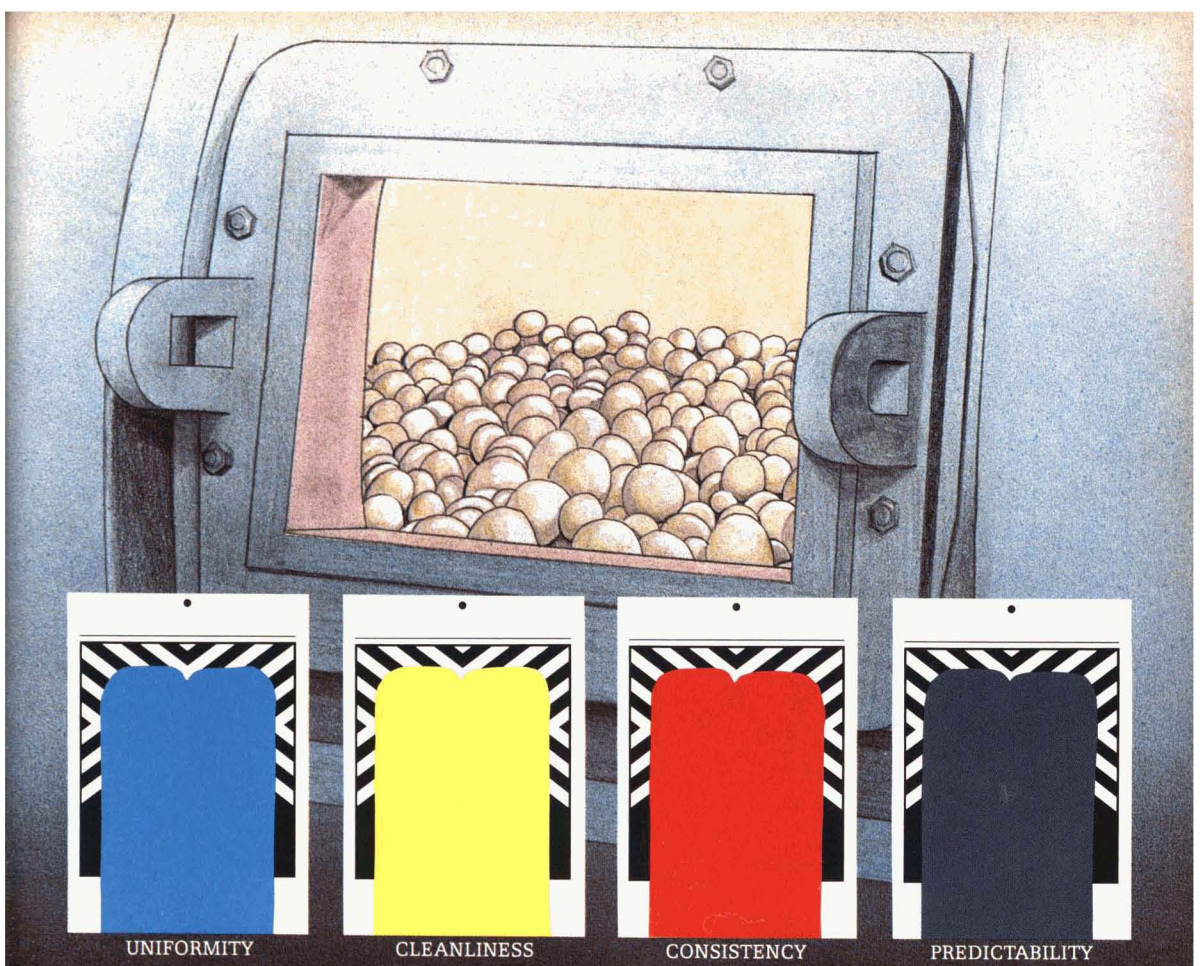

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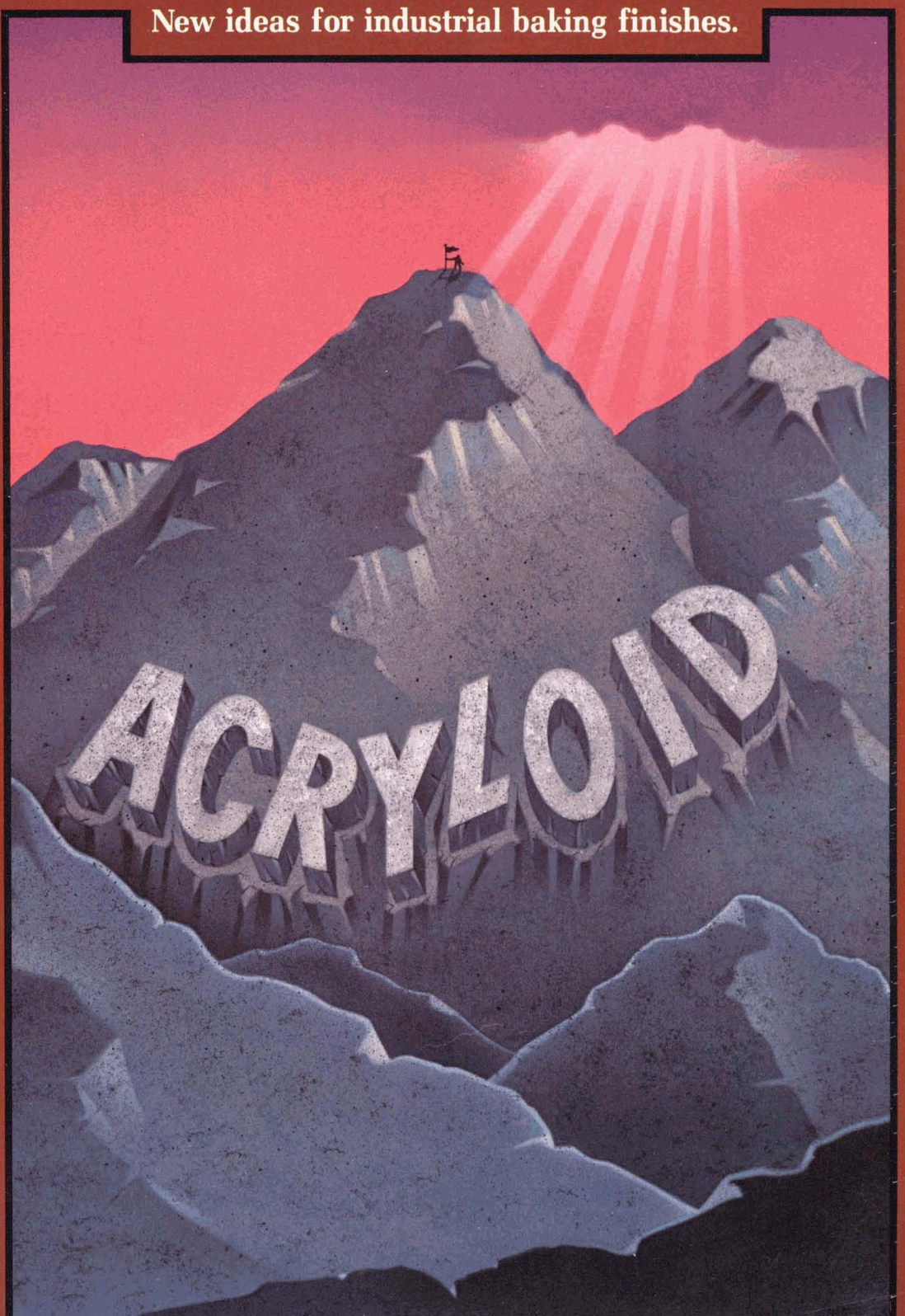

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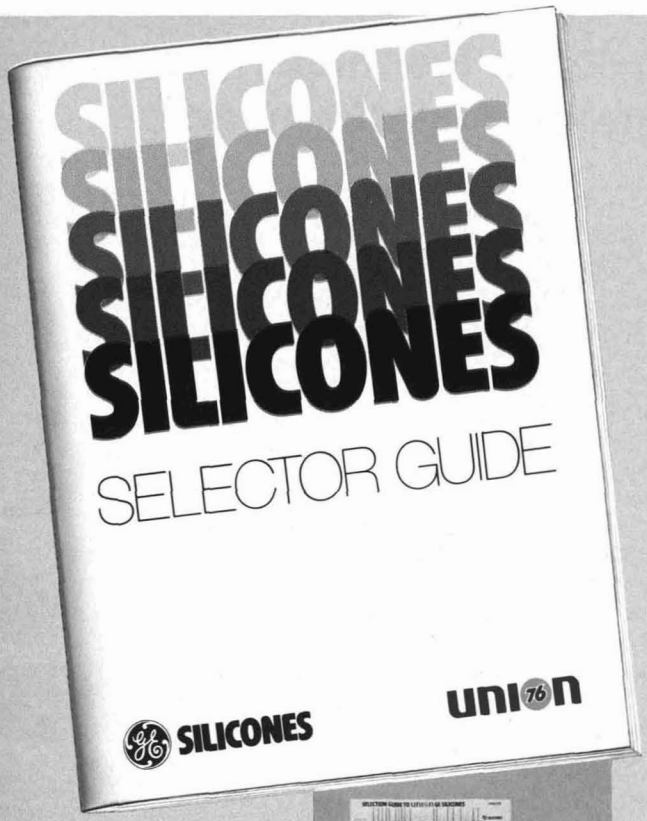

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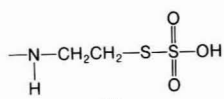
1982 JOSEPH J. MATTIELLO MEMORIAL LECTURE

Bunte Salts As Crosslinking Agents In Thermosetting Water-Borne Polymers

Shelby F. Thames
University of Southern Mississippi

Substituted aminoethanethiosulfuric acids, or bunte salts (I),



(I)

have been incorporated into the structure of preformed thermoplastic polymers soluble only, prior to bunte salt incorporation, in organic solvents. However, inclusion of the bunte salt group as part of the polymer structure renders the polymer water soluble. It likewise provides a moiety capable of thermal disproportionation and subsequent crosslinking.

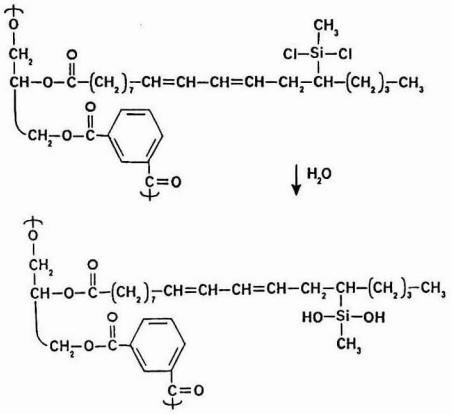
It has been shown previously that the S-S bond of the bunte salt is labile toward ionizing radiation, acid hydrolysis, reducing agents, and oxidizing agents. Thus, the availability of bunte salt functionality as part of a polymer structure provides crosslinking capability, as well as rendering the polymer water sensitive prior to curing and water insensitive subsequent to curing. It has been shown that the bunte salt moiety will crosslink polymers at temperatures as low as 123° C. Much of the characterization of the polymers synthesized during this research effort is discussed, as well as mechanical properties of the thermoset species.

Presented at the 60th Annual Meeting of the Federation of Societies for Coatings Technology in Washington, D.C., November 5, 1982.

*Southern Station, Box 5125, Hattiesburg, MS 39406.

INTRODUCTION

The coatings industry continues to be in search of crosslinking mechanisms for the purpose of producing high molecular weight, thermosetting polymers. By way of example, the 1981 Mattiello lecturer, Werner Blank, described his extensive and outstanding research in the area of crosslinking species for the polymer industry. Likewise, there has been a move to water-borne and high solids coatings with the accompanying economic and environmental advantages of water as the primary carrier medium. Federal regulations limiting organic solvent emissions and the dramatic cost escalation of organics have been motivating factors for such developments. Yet, while much has been accomplished with respect to water-borne technology, there remains more to learn, more to do, more frontiers to be conquered. Ideally, one would prefer to generate a coating system with little, if any, additives as part of the formulations. The ability to refrain from the use of, or lower the concentration of defoamers, viscosity control agents, coalescing agents, emulsifiers, and the like would constitute an improved technology. It is to this end that our research laboratories have directed some probative efforts. It was some years ago when our first such thrust was presented to the coatings industry in the July 1971 issue of the JOURNAL OF COATINGS TECHNOLOGY.[1] In that work, it was shown that organochlorosilanes could be attached to an already existing alkyd resin. Upon hydrolysis of the chlorosilane moiety, a silanol group was produced which remained stable in the aqueous medium and provided the necessary polymer hydrophilicity to allow the existence of a stable emulsion without the addition of external surfactants (Scheme I).

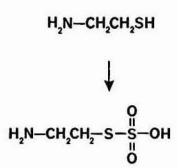


(I)

Although the resultant film properties of either the air dried or stoved products were excellent, the process had a major disadvantage in the liberation of hydrochloric acid during the hydrolysis step to the silanol. The acidic by-product was a major drawback to what otherwise was an interesting approach to the preparation of water-borne polymers containing no external surfactants or emulsifying agents.

However, the attendant advantages of an internal, water-loving substituent, which would be rendered hydrophobic upon curing, remained to us a desirable yet elusive structural feature.

It was known to us that the water solubility of aminoethane thiol, $H_2N—CH_2CH_2SH$, an effective antiradiation drug, could be enhanced by derivation to aminoethanethiosulfuric acid (AETSA), $H_2N—CH_2CH_2S—SO_3H$; a Bunte salt derivative (Scheme 2).



(2)

This held major importance as mercaptoethyl amine did not possess sufficient hydrophilicity to allow adequate passage through the "water loving" portion of the body. Thus, "coverage" of the mercapto moiety with the Bunte salt improved water solubility of the respective drug and did not adversely affect the antiradiation activity of the drug.

Certainly, it would be expected that such an amino acid as AETSA would have significant ionic character. This has been proposed by Keefe and Stewart.[2] These investigators provided evidence to confirm molecules crystallized in a Zwitterion bonded dimer state which were capable of capturing and holding a free radical. In this way, the body was provided radiation protection. Furthermore, treatment of Bunte salts with ionizing radiation, reducing and oxidizing agents, and acid hydrolysis is known to provide for S—S cleavage and to produce yet another reactive moiety.

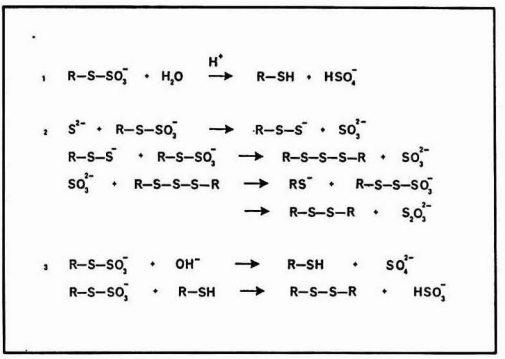
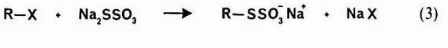


Figure 1—Potential reactions of Bunte salts

These reactions, combined with the works of Footner and Smiles,[3] who first showed that Bunte salts react with thiols in alkaline solution to give rise to disulfides, established this group as a reactive and potentially attractive route to crosslinked polymers (*Figure* 1).

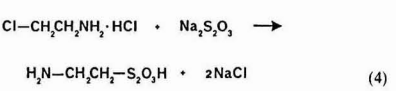
Others[4] have incorporated the Bunte salt group into polymer structures for the purpose of setting wool and the preparation of water *insoluble* crosslinked polymers.[5] However, the incorporation of the freely basic AETSA as a stabilizing, solubilizing, and crosslinking group has not, to our knowledge, been reported. It was of great interest, therefore, to obtain polymer(s) with such a substituent for evaluation.

The original method for the synthesis of sodium S-alkylthiosulfates consisted of the reaction of alkyl halides with sodium thiosulfate in aqueous solution at high temperatures. This method has also been extended to the preparation of Bunte salts from secondary alkyl halides.[6] (Scheme 3).



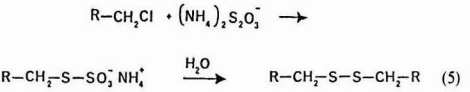
(3)

It is through such a reaction that AETSA can be prepared from beta-chloroethylamine hydrochloride (Scheme 4).



(4)

Thus, while it is well known that alkyl halides can, and do, react with thiosulfate salts, it is also known that the resulting products have shown tendencies toward instability.[7] This feature, which if evident and uncontrollable in coatings materials, would render the presence of Bunte salts unacceptable, as spontaneous coupling of the substituted polymer would provide for gellation under a variety of experimental conditions (Scheme 5).



(5)

Table 1—Degree of Polymer Substitution As Related to Chlorine Content

Polymer	Chlorine Content %
Pech control	36.9
DS = 20%	25.4
DS = 25%	21.7
DS = 33%	19.7
DS = 50%	11.2

Table 2—Acid Value

Polymer	Chlorine Content %	Acid Value mg/KOH/gr Sample
DS = 20%	25.4	11.3
DS = 33%	19.7	113.9

It occurred to us, therefore, that the incorporation of AETSA into a polymeric structure, with its attendant ability to form a Zwitterion, might well serve as a stabilizing influence to the polymer as it had to the antiradiation drug, mercaptoethylamine. There appeared also the probability for desired instability of the S—S linkage *under thermal* curing conditions. Indeed, the thermal, homolytic dissociation of initiators is the most widely used mode of generating radicals to initiate polymerization. Thermally catalyzed polymerizations of this type are, however, usually rather limited to compounds with bond dissociation energies in the range of 25-40 kcal/mole. Compounds with higher or lower dissociation energies will dissociate too slowly or rapidly. As a result, only a few classes of compounds—including those with O—O, S—S, N—O bonds—possess the desired range of dissociation energies.

The incorporation of a stable Bunte salt (S—S) linkage as part of a polymer structure, therefore, provided a unique opportunity for a thermally catalyzed crosslinking mechanism.

In summary, incorporation of AETSA into a polymer molecule was seen to provide for several potential advantages:

(1) There is the potential for thermal decomposition of the water sensitive thiosulfate group, thereby providing for crosslinking potential and, at the same time, enhancing polymer hydrophobicity.

(2) The incorporation of AETSA would also provide potential for polymer emulsification or even solubilization depending upon the degree of substitution. In this way, little or no external emulsifiers would be required to render the polymer water borne, as the availability of the AETSA would serve this purpose.

(3) There exists the potential for the achievement of controlled crosslinked polymers possessing improved physical and chemical properties.

(4) There exists the potential for polymer stabilization not obtained with Bunte salt derivatives lacking the amino-ethyl stabilizing group.

AETSA was, therefore, incorporated as part of a polymer structure by the nucleophilic displacement of the primary alkyl chloride of poly(epichlorohydrin).

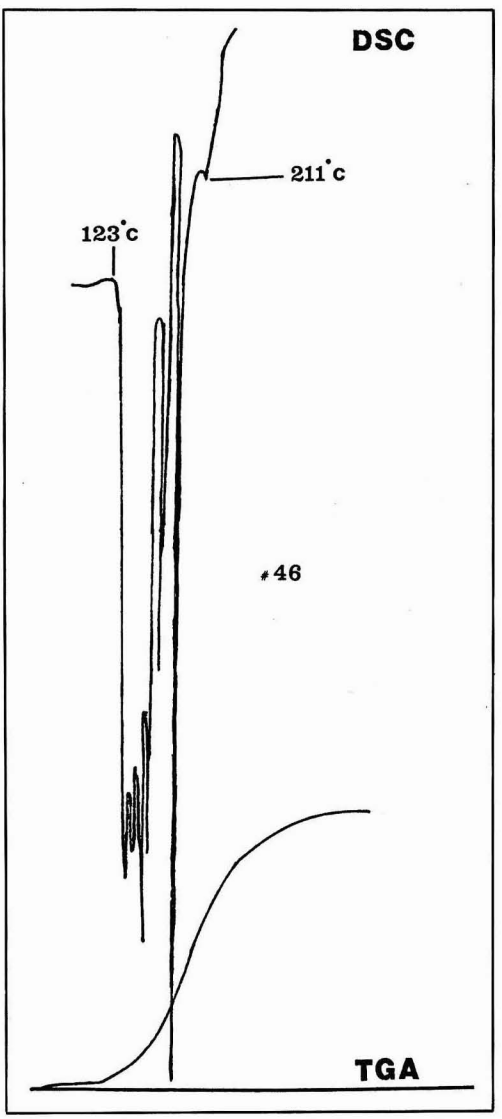


Figure 2—DSC—TGA Thermograms for Bunte salt polymer

Table 3—Thermogravimetric Analysis

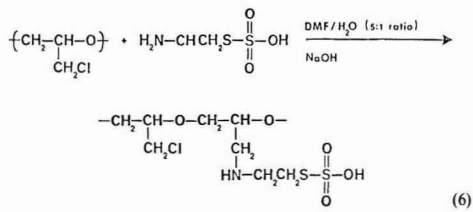
Polymer	Chlorine Content %	Weight Loss %
Pech control	36.9	0.25
DS = 20%	25.4	1.97
DS = 25%	21.7	2.35
DS = 33%	19.7	4.14
DS = 50%	11.2	1.21

Table 4—Polymer Solubility

Polymer	Chlorine Content %	Solubility Characteristics
Pech control	36.9	THF, DMF—Soluble water insoluble
DS = 20%	25.4	Emulsion
DS = 25%	21.7	Water soluble
DS = 33%	19.7	Water soluble
DS = 50%	11.2	Water soluble

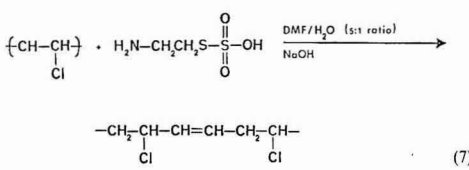
RESULTS AND DISCUSSION

It was found that the displacement reaction could be affected in a 5:1 DMF/water solvent mixture, with subsequent heating at 85°C for 48 hours. Isolation of the resulting substituted epichlorohydrin polymer was affected by precipitation with ammonium chloride and removal of any excess AETSA with methanol. The isolated polymer was then analyzed for chlorine content for determination of the level of AETSA substitution (Scheme 6).



(6)

A similar reaction was affected with poly(vinylchloride) but with little success. Infrared analysis of the reaction product showed no Bunte salt absorptions. It did show considerable double bond (C=C) absorption resulting from a substantial level of elimination successfully competing with the desired displacement reaction (Scheme 7).



(7)

Modification of reaction conditions provided for essentially identical results, irrespective of whether tetrahydrofuran was employed in lieu of DMF or whether sodium hydroxide or pyridine was employed as the base. Likewise, none of the resulting products were soluble in acid or base, further indicating the absence of the desired AETSA group.

It was obvious therefore that for these initial studies poly(epichlorohydrin) was the polymer of choice. The results are depicted in *Table* 1 where the polymer degree of substitution is related to its chlorine content.

That nucleophilic substitution of the primary alkyl halide had in fact been affected was confirmed by elemental analyses for not only chlorine but carbon, hydrogen, nitrogen, and sulphur, as well as infrared spectroscopy analyses relying principally upon the characteristic Bunte salt absorptions of 1020 cm^{-1} and 630 cm^{-1}. Furthermore, acid value determinations (*Table* 2) confirmed the presence and increasing concentration of AETSA with increasing degree of substitution, D.S.

Having synthesized and confirmed the presence of an AETSA containing polymer, we directed our attention to its thermal decomposition characteristics. Thermochemical analyses, via differential scanning calorimety (DSC) and the thermogravimetric analysis (TGA), were affected simultaneously with the result that weight losses were noted with thermal transitions at and above 123°C (*Figure* 2).

Temperature increases above 123°C brought about an accelerated weight loss, suggesting temperature and time dependence for Bunte salt decomposition. It was noted that weight loss increased with increases in D.S. in all cases except the highly substituted D.S. = 50% polymer. We postulate that the high degree of substitution renders

Table 5—Impact Resistance

Polymer	Chlorine Content %	Air Dry (in.-lb)	Desiccator Dry (in.-lb)	Heated 140°C for 40 min (in.-lb)
Pech control	36.9	>70	>70	>70
DS = 20%	25.4	>70	>70	>70
DS = 25%	21.7	>70	>70	35
DS = 33%	19.7	>70	>70	40
DS = 50%	11.2	>70	<1	<1

Table 6—Moisture Absorption

Polymer	Chlorine Content %	Weight Gain %
Pech control	36.9	1.2
DS = 20%	25.4	4.7
DS = 25%	21.7	8.3
DS = 33%	19.7	7.2
DS = 50%	11.2	25.0

Table 7—Instron Data

Polymer	Chlorine Content %	Air Dry		Dessicator Dry		Heated 140° C for 40 minutes	
		Ultimate Strength g/cm²	Elongation %	Ultimate Strength g/cm²	Elongation %	Ultimate Strength g/cm²	Elongation %
Pech control	36.9	12,057	1,403	12,000	1,400	5,249	1,373
DS = 20%	25.4	4,202	>4,400	23,312	622	103,609	375
DS = 25%	21.7	2,624	>4,400	72,680	172	110,673	3.75
DS = 33%	19.7	2,673	>4,400	83,661	36	113,188	2.27
DS = 50%	11.2	3,621	417	—	Cracks during drying	Too brittle for film preparation	

the product inherently unstable. Thus, weight loss is spontaneous and occurs prior to the curing or heating process (*Table* 3).

It was of interest also to determine the identity of the weight loss products and this was accomplished by gas chromatography/mass spectroscopy (GC/MS) analyses. A sample of substituted polymer was subjected to controlled heating in the GC/MS unit with the result that both SO and SO_2 were liberated at 135°C.

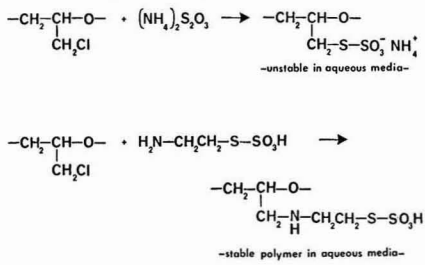
As further confirmation, additional polymer was annealed at 152°C to affect thiosulfate decomposition, if indeed it does occur. The annealed polymer was then pyrolyzed in the GC/MS at 230°C with the result that only minute amounts of SO and SO_2 were detected. Confirmation was, therefore, accomplished that Bunte salt decomposition is thermally induced without catalysis at temperatures as low as 125–135°C and that the principal by-products are SO and SO_2.

We next observed the effect that nucleophilic substitution of AETSA would have on polymer glass transition temperature. It was found that T_g was not decreased but instead was increased in the order of from 5 to 15°C for polymers with chlorine content of 25.4% to 11.2%, respectively.

Having confirmed the practicality of substituting AETSA onto a polymer backbone with subsequent potential for thermal decomposition, our attention turned to the study of water solubility of the substituted polymer. It is significant, yet not surprising, that substitution of AETSA transforms an organic soluble polymer into a water-borne if not water-soluble polymer, with no added external surfactants. Furthermore, such polymers have maintained their stability in aqueous medium for more than six months. (*Table* 4).

Indeed, and as expected, higher substitution levels of AETSA increases water solubility of the polymer.

Other investigators have, however, reported apparent instability of similarly substituted polymers when only ammonium thiosulfate was employed as the nucleophilic reagent. Such a reaction provides for a Bunte salt without the aminoethyl-stabilizing group present in the polymer reported herein (Scheme 8).



(8)

At this stage of our research efforts, it was of interest to determine the extent of the influence expected from the AETSA group upon physical properties. It was to this end that film forming properties were investigated and

Table 8—Pencil Hardness[a]

Polymer	Chlorine Content %	Air Dry	Desiccator Dry	Heated 140° C for 40 min
Pech control	36.9	6B	6B	6B
DS = 20%	25.43	6B	B	6H
DS = 25%	21.7	6B	HB	6H
DS = 33%	19.7	6B	HB	6H
DS = 50%	11.2	6B	Films cracks during drying	6H

(a) Soft to hard: 6B–5B–4B–3B–2B–B–HB–F–H–2H–3H–4H–5H–6H.

Table 9—Sward Rocker Hardness

Polymer	Chlorine Content %	Air Dry	Desiccator Dry	Heated 140° C for 40 min
Pech control	36.9	3	3	2
DS = 20%	25.4	2	4	7
DS = 25%	21.7	1	5	10
DS = 33%	19.7	3	4	14
DS = 50%	11.2	<1	Cracks during drying	13

Table 10—MEK Rub

Polymer	Chlorine Content %	Heated 140° C for 40 min
Pech control	36.9	2
DS = 20%	25.4	50
DS = 25%	21.7	50
DS = 33%	19.7	95
DS = 50%	11.2	Cloudy 125

physical testing measurements were affected. It was gratifying to find that films of the substituted polymer can be prepared in the typical manner by application to, and subsequent removal from, a non-adhering substrate. Likewise, application to metal panels provided additional test specimens.

Thermal curing of the elastomeric control (Pech) as well as the substituted polymer (DS = 20%) provided films that showed no evidence of rupture at 70 in.-lb upon direct impact (*Table* 5).

Higher levels of substitution, and subsequently greater crosslinking, resulted in a decrease in impact resistance from greater than 70 in.-lb to 35 in.-lb, for DS = 20% and DS = 25%, respectively. Further reductions in impact resistance were generally noted with increased levels of substitution. It is interesting, and should be noted, that air-dried polymer, irrespective of its degree of substitution, retained an impact resistance of greater than 70 in.-lb. On the other hand, polymer dried in a desiccator at ambient temperature retained its impact resistance of 70 in.-lb up to DS = 33% while there was a precipitous decline at DS = 50%. The effects noted for the air-dried polymer are obviously water plasticizing effects while the absence of this effect is noted with the desiccator dried product, DS = 50%. Indeed, moisture absorption data confirms the greater water absorptivity of highly substituted polymer (*Table* 6).

Tensile strength and elongation data again confirm the premise of enhanced Bunte salt thermal degradation/crosslinking with increasing levels of Bunte salt, i.e., higher DS levels.

Higher levels of Bunte salt incorporation with thermal curing provides for a 21-fold increase in tensile strength and a 605-fold decrease in elongation (*Table* 7).

However, it should be noted that with a relatively low level of substitution (DS = 20%), an exceptionally strong and elastic product is produced. Furthermore, comparison of data for air-dried vs. desiccator dried films solidifies the tenet of film plasticization by water, as the desiccator dried products are significantly less elastic than are the air-dried products. In the latter instance, the presence of significant amounts of water provides very elastic yet weaker films than is the case for desiccator dried films.

Table 11—Crosshatch Adhesion

Polymer	Chlorine Content %	Air Dry %	Desiccator Dry %	Heated 140° C for % 40 Minutes
Pech Control	36.9	10	10	95
DS = 20%	25.4	100	100	100
DS = 25%	21.7	100	100	100
DS = 33%	19.7	100	100	100
DS = 50%	11.2	100	Cracked during drying	100

It is interesting that examination of the stress/strain profile for the lightly crosslinked product, DS = 20%, is quite similar to that of the Pech control but develops significantly greater strength.

In general, pencil and Sward rocker hardness determinations were consistent in that a given polymer developed greater degrees of hardness as the drying process progressed from air dry to desiccator dry to thermal curing (*Tables* 8 and 9). Examination of these data show that the higher moisture content polymers (air dry) are softer with an increase in hardness developing through the formation of desiccator dried films to the thermally cured polymers. The air-dried products are quite soft while the thermally crosslinked products are extremely hard even at low levels of substitution (DS = 20%).

Further evidence supporting the concept of crosslinking via the Bunte salt substituent was provided by determination of methyl ethyl ketone (MEK) rubs for the thermally cured products at each level of substitution (*Table* 10).

It was found that MEK rubs increased from 2 for the control, to 50 for DS = 20% and beyond, to greater than 125 for the highest crosslinked polymer, DS = 50%. Again, relatively low levels of substitution provided for significant property alterations of the resultant thermally cured films.

And, finally, the effects of Bunte salt substitution upon adhesion were confirmed and indeed they are dramatic. (*Table* 11).

Crosshatch adhesion to glass showed significant increases over that of the control with all levels of Bunte salt and for all modes of film drying. The greatest improvements in adhesion were noted for the air-dried and desiccator-dried products with only modest increases over that of the control noted for the thermally cured product.

CONCLUSION

In summary, it has been shown that AETSA incorporation into an otherwise organic soluble polymer such as poly(epichlorohydrin) transforms the polymer into a water-soluble or water-borne product. Water solubility is enhanced by higher levels of Bunte salt incorporation.

Polymers with moderate levels of AETSA are stable in aqueous media for long periods of time without the addition of any external emulsification agents. This is contrary to previous reports of other Bunte salt substituted polymers which showed solution instability. However, it should be emphasized that such Bunte salt substituted polymers contained the —S—SO_3H group and did not possess the freely basic aminoethyl group as described in this work.

AETSA substituted polymers have been shown to undergo uncatalyzed thermal crosslinking at 123–135°C and to provide physical and chemical properties vastly different and attractive from that of the parent control polymer.

ACKNOWLEDGMENT

The able assistance of Mr. Jeffery Harris, a Graduate Research Assistant, is acknowledged. Mr. Harris affected all laboratory experimentation reported herein as partial requirements for the Doctor of Philosophy degree.

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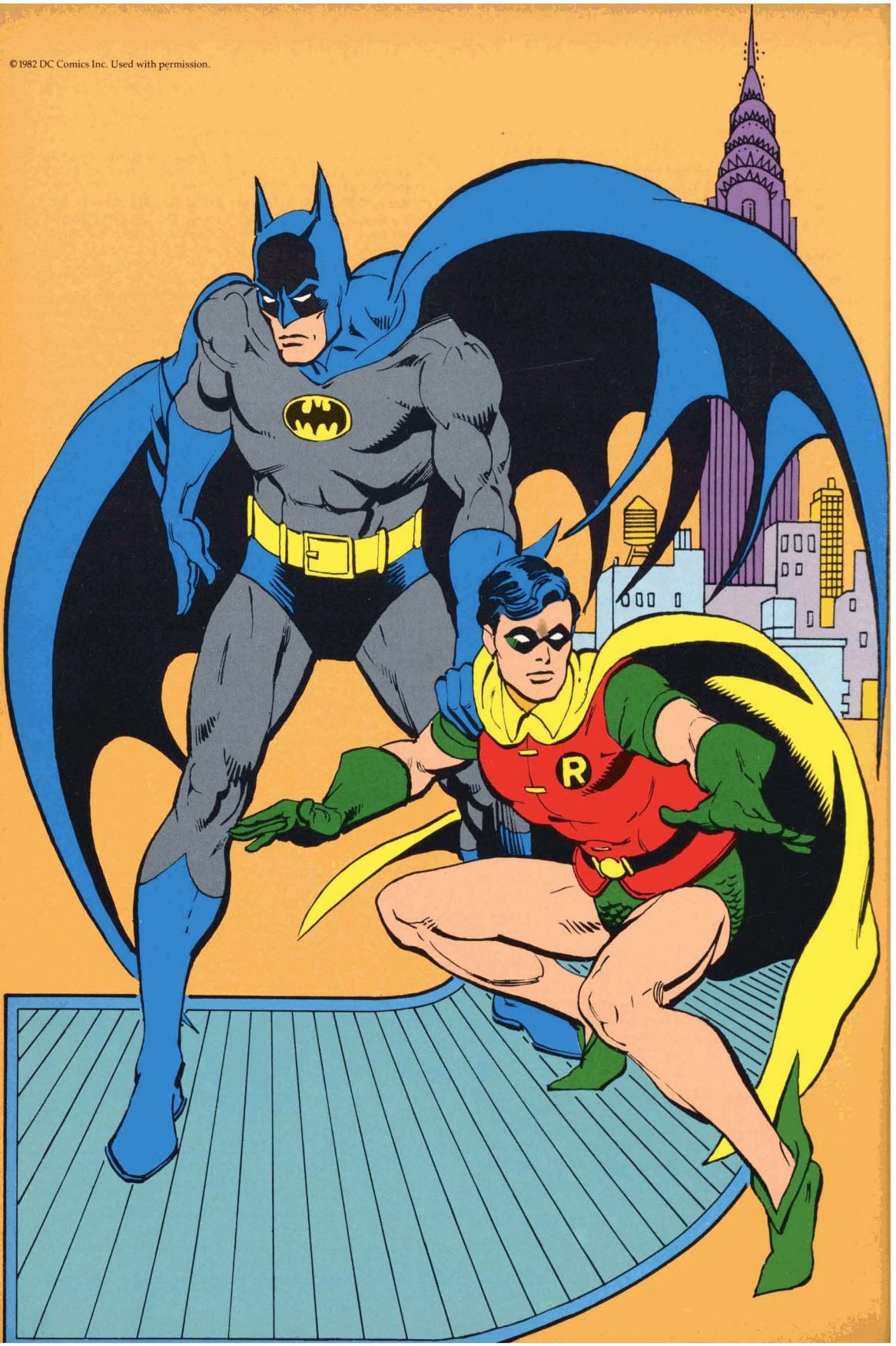

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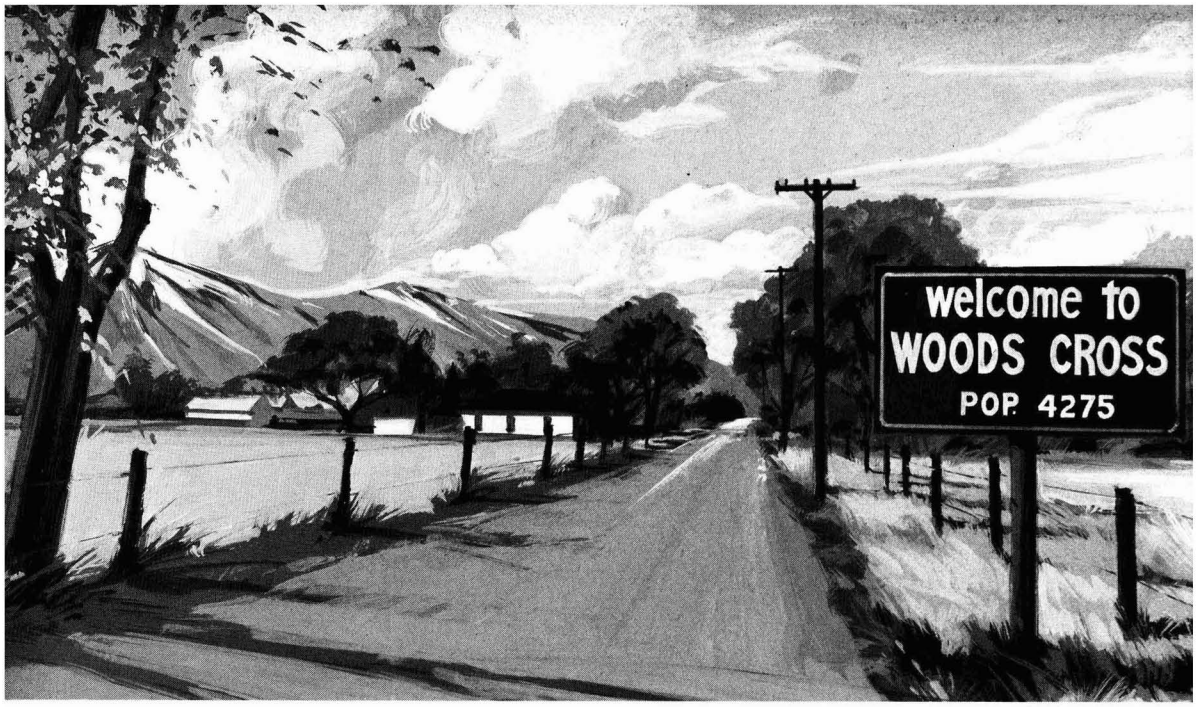

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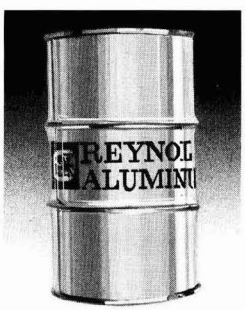

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Copolymers of Polystyrene Glycol And Linseed Oil Modified Glyceryl Adipate For Surface Coatings

Suman Agarwala
Harcourt Butler Technological Institute*

The preparation of polyester coatings of the alkyd type using adipic acid, glycerol, polystyrene glycol, and linseed oil is reported in which phthalic anhydride is completely replaced by adipic acid. Maximum amount of polystyrene glycol compatible during the synthesis of copolymer was investigated. In addition, other samples having lower amounts of polystyrene glycol were also prepared. A control sample of phthalic alkyd was prepared. Film properties of the xylene solution of copolymers and the control sample were evaluated for drying characteristics, flexibility and adhesion, scratch hardness, and resistance to water, acid, alkali, and solvent. It was found that copolymers had better physical and chemical properties as compared to the control. The results revealed that Phthalic anhydride can be conveniently replaced by adipic acid and polystyrene glycol with advantages of incorporating polystyrene moiety which also contributes the benzene rings necessary for the required hardness in these copolymers.

INTRODUCTION

Polystyrene is a well known polymer having excellent water and chemical resistance.[1] However, in surface coatings, it cannot be used directly due to its noncompatibility and nonreactivity with resins and polymers used in this field.[2] Introduction of functional groups like chloro,[3-5] sulfo,[6,7] nitro,[8,9] and hydroxy,[10-12] etc., into the polystyrene chain makes it reactive with various conventional condensation polymers.[13] Hence, the functionalized polystyrene can act as a versatile intermediate in the chain extension reaction, e.g., synthesis of graft and block copolymers.

Out of many functional groups, the hydroxyl group has successfully been introduced at the end of the polystyrene chain yielding polystyrene glycol.[12] The reactivity of this polystyrene glycol (PG) has been tested by its esterification reactions with phthalic anhydride,[12] linseed fatty acids,[14] and rosin.[15] Hence, polystyrene glycol serves a two-fold function. First, it provides the hydroxyl group which can replace glycerol and other aliphatic polyhydric alcohols from the conventional condensation polymers; second, a long chain of polystyrene can be incorporated which will contribute the required hardness and excellent water and chemical resistance to the product.

Alkyds are prepared from a dibasic acid, polyhydric alcohol (glycerol), and an oil. Most commonly used acids are aromatic acids, such as phthalic, which provides the carboxyl (—COOH) functional reactive sites and contributes toward the hardness of the alkyd due to the presence of benzene rings. If, aliphatic acids, such as formic, succinic, adipic, suberic, azelaic and sebacic, are used, the alkyds do not possess enough hardness.[16,17] However, hardness of these aliphatic acid based alkyds can be improved by incorporating other components having aromatic rings. One such material can be polystyrene glycol which has been incorporated into fatty acids,[14] ester gum,[15] and alkyds[18,19] by partially replacing the glycerol. In these cases, the preferred formulation technique is to replace a portion of the glycerol with that amount of reactive polystyrene glycol essential on the basis of hydroxyl value. Thus, in the preparation of alkyd from aliphatic acids, use of the polystyrene glycol will contribute the benzene rings necessary for hardness and other useful properties as well. This approach closely resembles the preparation of the polyacrylate modified water-borne alkyds[20] in which low molecular weight

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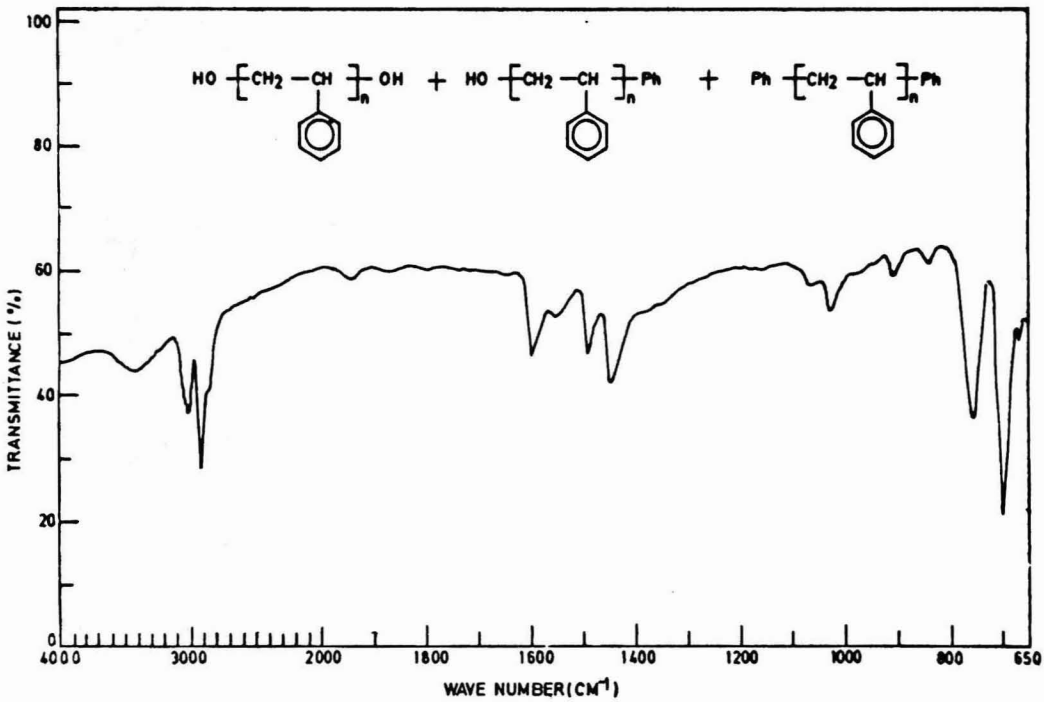


Figure 1—IR spectrum of the polystyrene glycol sample

acrylic polymers with both hydroxyl and carboxyl functionalities are prepared and charged to the alkyd reactor with the conventional alkyd components.

The aim of this work is to replace phthalic anhydride from the conventional alkyd and to prepare a polyester coating of the alkyd type based on utilization of polymeric alcohol and aliphatic acids/anhydrides. It is a general practice to prepare a new polymer either by chemical modification of existing ones or by replacing one of the ingredients to see the effect of that replacement. Further, if aromatic acids can be replaced successfully by aliphatic acids without greatly affecting the final properties of the product, a new series of the polymers can be developed using less expensive aliphatic acids. It also gives a new approach for utilization of other aliphatic acids for synthesis of alkyds, which are the by-product of different reactions and are available at lower costs. Hence, this provides the use of local resources in the advancement of technology.

In the present study, therefore, polystyrene glycol and adipic acid were used as a replacement for phthalic anhydride. Adipic acid is a main component in nylon and is an aliphatic acid having a molecular weight (146) of nearly that of phthalic anhydride. Both are solid white materials. The melting point of phthalic anhydride is 132°C whereas adipic acid[21] is 151°C. In this case, the final product would be a graft copolymer of polystyrene glycol and linseed oil modified glyceryl adipate.

Film properties of these copolymers were studied and compared with those of the conventional phthalic alkyd, which served as the control.

EXPERIMENTAL

Materials

Laboratory reagent (LR) grade of glycerol and phthalic anhydride and alkali refined linseed oil were used for the preparation of the control sample, a phthalic alkyd of 50% oil length.

Polystyrene glycol[12] was prepared by free radical polymerization of styrene using benzoyl peroxide as the initiator, followed by hydrolysis of the benzoate end groups. The sample had a hydroxyl value of 39.8 and number average molecular weight of 2742 as determined by osmometry. The IR spectrum (KBr) of polystyrene glycol also exhibited the presence of a hydroxyl group which appeared as a broad absorption vibration in the region 3450 cm^{-1}, as shown in *Figure* 1. Presence of a hydroxyl group in the polystyrene chain was also confirmed by the reaction of polystyrene glycol with mono-

Table 1—Composition and Physical Characteristics

Sample	Parts by weight: Linseed Oil	Acid	Glycerol	Polystyrene Glycol	Benzene Rings[a] (moles)	% PG in Copolymer[a]	Acid Value	Clarity of the Film	Drying Time: Surface Dry (min)	Hard Dry (hr)	Scratch Hardness g	Flexibility (⅛" mandral)
Control	50.0	38.0[b]	18.0	—	0.256	—	9	Clear	60	<6	2,000	Pass
Copolymer 1	50.0	42.6[c]	20.3	12	0.114	10	10	Clear	35	<4	1,000	Pass
Copolymer 2	50.0	42.6[c]	20.0	23	0.218	20	14	Clear	30	<4	1,300	Pass
Copolymer 3	50.0	42.6[c]	19.6	41	0.389	30	12	Clear	25	<3	1,600	Pass
Copolymer 4	50.0	42.6[c]	19.4	51	0.484	35[d]	13	Clear	20	<3	1,800	Pass

(a) Calculated.
(b) Phthalic Anhydride.
(c) Adipic Acid.
(d) Maximum Compatible.

basic acids, such as linseed fatty acids and rosin, and dibasic acid anhydride, such as phthalic anhydride.

Adipic acid (LR grade), polystyrene glycol, and glycerol were used along with linseed oil for preparing the copolymer samples of 50% oil length by the monoglyceride process. Calcium oxide, 0.2% on the weight of oil was used as the catalyst for glycerolysis. Lead and cobalt naphthenates were used as driers in soluble form equivalent to 0.5% Pb and 0.05% Co as metal to resin solids.[22] Xylene (LR grade) was used as solvent for copolymers.

Preparation of Copolymers

During the preparation of copolymers, polystyrene glycol was added along with adipic acid after formation of the monoglycerides so that adipic acid could react preferentially with the polystyrene glycol and monoglycerides. However, in the end, the high acid value of the product decreased with the addition of glycerol.

The maximum amount of polystyrene glycol, which was compatible with the system and rendered a clear product of the copolymer using adipic acid, was investigated. In addition, three more samples of copolymer having lower amounts of polystyrene glycol than the maximum amount were also prepared. Thus, four samples of copolymers of polystyrene glycol and linseed oil modified glyceryl adipate resin containing 35, 30, 20, and 10% polystyrene glycol were prepared. The preferred formulating technique was to replace a portion of the glycerol with the equivalent amount of reactive polystyrene glycol calculated on the basis of hydroxyl value. The formulations for each sample are shown in *Table* 1. A typical preparatory method is described below.

Linseed oil and glycerol were added to a three-neck flask fitted with a stirrer, thermometer, and Dean and Stark water separator. The mixture was heated to 180°C. The calcium oxide was added. The temperature for glycerolysis was maintained at 225°C. Formation of monoglyceride was checked at regular intervals of 15 min by dissolving one part of the sample in three parts of methanol. Monoglyceride formed in an hour. The mass was cooled to 180°C and powdered adipic acid and polystyrene glycol were added gradually within 60 min. Heating was continued at 205°C for 150 min when the required viscosity was obtained. The acid value of the final product, a clear viscous liquid, is shown in *Table* 1.

Preparation of the Control Sample Of Phthalic Alkyd

Copolymers of polystyrene glycol and linseed oil modified glyceryl adipate were compared with the linseed oil modified phthalic alkyd which served as a control. The concentration of aromatic rings in the control sample was equivalent to that in the copolymer sample containing the maximum compatible amount of polystyrene glycol, i.e., Copolymer 4 containing 35% polystyrene glycol. The control sample was prepared by the same monoglyceride process used to prepare the copolymers. The formulation is shown in *Table* 1. The preparation is as follows: Linseed oil and glycerol (25% by weight of oil) were heated in the presence of calcium oxide for the preparation of monoglyceride. Phthalic anhydride and the remaining glycerol were added to the monoglyceride in 30 min at 180°C with constant stirring. Then, the temperature was raised to 220°C. Heating was continued until the desired viscosity was obtained.

RESULTS AND DISCUSSION

Compatibility of Polystyrene Glycol

Reactivity of polystyrene glycol with adipic acid and glyceryl adipate of high acid value was first examined. The condensation reaction gave clear products of decreased acid value showing that polystyrene glycol is an efficient diol for reaction with aliphatic acids and their glyceryl esters. The above experiments were necessary because polystyrene is not compatible with oils and, therefore, cannot be blended with oil modified alkyds as such. Reaction of polystyrene glycol and glyceryl adipate made it possible to prepare the oil modified glyceryl adipate having the polystyrene moiety. The copolymers of polystyrene glycol gave clear films showing that copolymerization actually took place through chemical

Table 2—Resistance of Control Phthalic Alkyd and Copolymers To Water, Acid, Alkali, and Solvent at Ambient Temperature (25° C)

Sample	Condition of the Film Immersed[a]						
	Distilled Water 20 days	Hydrochloric Acid 20 days	Sulphuric Acid 30 days	Nitric Acid 10 days	Sodium Carbonate 3 days	Sodium Hydroxide ½ hr	Xylene 10 days
Control	0	1	2	0	0	0	0
Copolymer 1	0	1	2	0	1	0	1
Copolymer 2	1	2	3	1	1	0	2
Copolymer 3	2	3	4	2	2	1	3
Copolymer 4	3	3	4	2	3	2	4

(a) Legend: 5—practically unaffected; 4—slight loss of gloss; 3—loss of gloss and change in color; 2—partially cracked; 1—cracked and partially removed; and 0—completely removed.

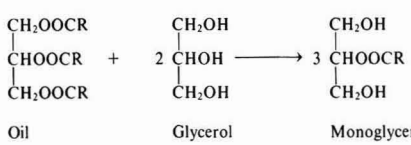
reaction between polystyrene glycol and the acid part of the adipate. The formation of the copolymer from polystyrene glycol supported Flory's concept of equal reactivity.

It is interesting to note that the aromatic rings provided by the phthalic anhydride in conventional alkyds are now being provided by polystyrene glycol in these copolymers. In fact, polystyrene glycol serves many functions. It provides the hydroxyl groups necessary for esterification reaction. In addition, it contributes hardness and water and chemical resistance. The alkyds formed may be regarded as modified styrenated alkyds. The main advantage of this approach is that the presence of conjugation in oil or fatty acid is not necessary. The polystyrene glycol easily reacts with adipic acid and becomes an integral part of the glyceryl adipate resin. Further, this process reduces/eliminates the presence of unbound styrene homopolymer. In the conventional method of styrenated alkyd preparation, styrene reacts at the conjugated double bond in fatty acids via the Diel's-Alder reaction. This reaction is not as simple as the reaction between polystyrene glycol and adipic acid.

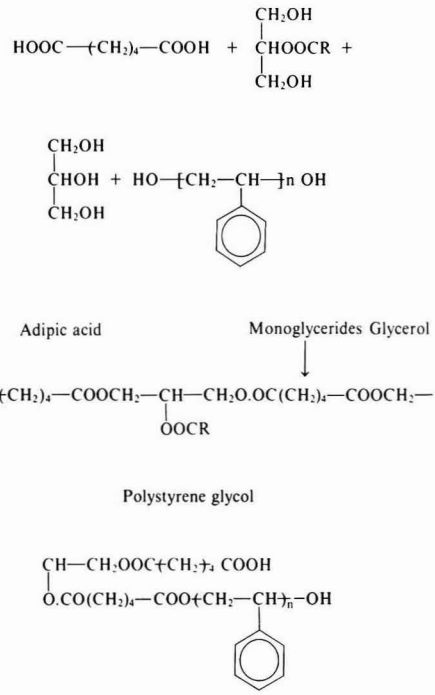
The copolymers having the maximum amount of polystyrene glycol (i.e., 35%), has approximately double the number of aromatic rings as that in the control sample of phthalic alkyd (as given in *Table* 1).

Chemical Structure of Copolymers

The first step in the synthesis of the copolymer is alcoholysis of the oil forming monoglyceride, as follows:



Monoglycerides, along with polystyrene glycol and glycerol, react with adipic acid and yield the copolymer as follows:



In the copolymer structure, the polystyrene glycol is not exclusively diol. It is also monosubstituted (polystyrene chains having an hydroxyl group at one end and phenyl at the other) with a non-reactive polystyrene chain having phenyl groups at both ends.[12] The mono-ol will also take part in the esterification reaction yielding copolymer. The nonreactive polystyrene homopolymer is, however, found to be compatible with the copolymers and does not affect the clarity of the product.

From the chemical structure shown above, the copolymer formed may be referred to as graft copolymer because one polymer (glyceryl adipate) has been synthesized in the presence of presynthesized polystyrene glycol. In this, glyceryl adipate resins may be regarded as the backbone, with polystyrene as the side chain.

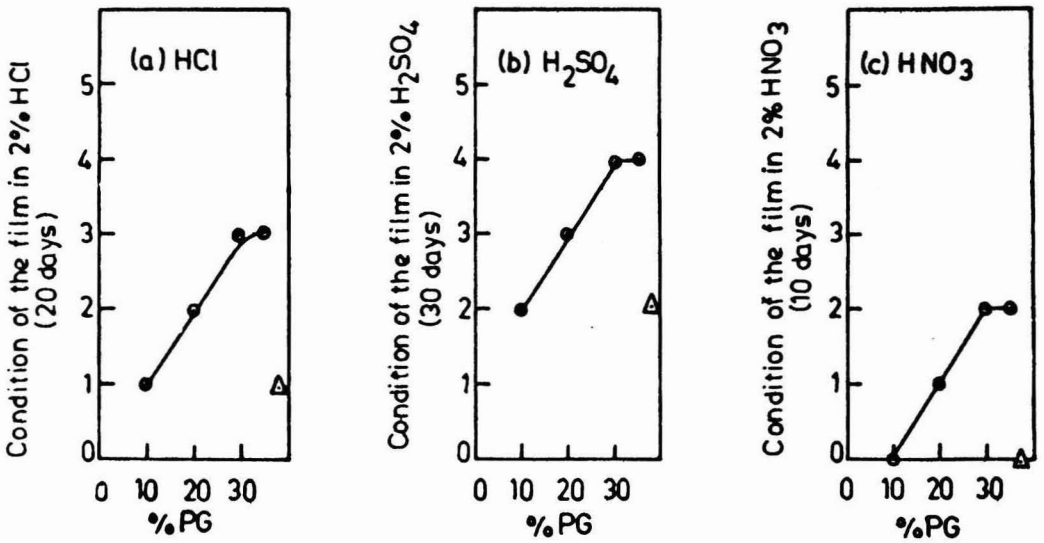


Figure 2—Acid resistance of the copolymers and the phthalic alkyd control: (a) hydrochloric, (b) sulfuric, and (c) nitric. Legend Δ-percent phthalic anhydride in the control sample; 0—completely removed; 1—cracked and partially removed; 2—partially cracked; 3—loss of gloss and change in color; 4—slight loss of gloss; 5—practically unaffected

Evaluation of Film Properties

In an investigation of the utility of the copolymers, the film properties of polystyrene glycol and oil modified glyceryl adipate resin were compared with those of the conventional phthalic alkyd. Xylene solutions containing 50% solids and driers in soluble form equivalent to 0.5% Pb and 0.05% Co were prepared. Films were brushed on 6 × 2 in. glass and tin panels and air-dried. The film properties were determined according to Indian standard methods, IS Specification number 101, 197.

The evaluation of film properties includes air-drying characteristics, flexibility and adhesion, scratch hardness, and resistance to water, acids, alkalies, and solvent. The results of these tests are given in *Tables* 1 and 2.

Drying Characteristics: Surface dry and hard dry times are recorded in *Table* 1. The drying times of the copolymer samples were much less than that of the control sample. Furthermore, the rate of drying slows with increasing amount of polystyrene glycol in the alkyd. In the copolymer, polystyrene is chemically linked with the alkyd and, therefore, has improved drying characteristics.

Flexibility and Adhesion: Flexibility and adhesion of dried films were tested on tin panels with a quarter-inch mandrel. No detachment of the film from the substrate or visible cracks in the films were observed in any of the samples, indicating that all the films had good flexibility and adhesion. Furthermore, it confirmed that polystyrene glycol reacted with glyceryl adipate.

Scratch Hardness: Scratch hardness of dried films was measured on tin panels with a mechanically operated instrument named as "Sheen-scratch hardness tester," by placing an increasing load over a hardened needle which moves on the film. Scratch hardness (in grams) of all samples is shown in *Table* 1. The results show that the copolymer having 35% polystyrene glycol has nearly the same scratch hardness as the control sample.

Water Resistance: Panels of all the samples were allowed to air-dry in a horizontal position for 48 hours. The edges of the glass panels were protected by wax before this test was performed and were immersed in distilled water at room temperature (25°C). The dipped portion of the film was examined at regular intervals of two days for appearance, i.e., loss of gloss, change in color, and other visible damage. All the samples were practically unaffected and passed the test. The panels were put back into the water to determine extreme water resistance. After 20 days, loss of gloss and change in color were observed for the sample having 35% polystyrene glycol. The sample having 30% polystyrene glycol showed partial cracks. The sample with 20% polystyrene glycol was cracked and partially removed, whereas, samples having 10% polystyrene glycol and the control sample were completely removed. These results suggest that the reaction of polystyrene glycol with alkyd prepared from adipic acid yields a copolymer having better water resistance as compared to phthalic alkyd.

Acid Resistance: Glass panels of all the samples were immersed in 2% solutions of hydrochloric, sulfuric, and nitric acids separately at room temperature (25°C). Panels were checked for any loss of gloss, change in color, and for any sign of disintegration at regular five-day intervals. *Figure* 2 illustrates the acid resistance of all the samples.

After 20 days of immersion in hydrochloric acid, samples having 35% and 30% polystyrene glycol showed loss of gloss and change in color. Those having 20% polystyrene glycol showed partial cracks. Cracks and partial removal of the film were observed in the cases of samples having 10% polystyrene glycol and the control sample.

After 30 days immersion in sulfuric acid, slight loss of gloss was observed in samples having 35% and 30% polystyrene glycol. Loss of gloss and change in color were observed in the sample having 20% polystyrene glycol. The samples having 10% polystyrene glycol and the control showed partial cracks.

Similarly, after 10 days of immersion in nitric acid, partial cracks were observed in samples having 35% and 30% polystyrene glycol. The samples having 10% and 20% polystyrene glycol were cracked and partially removed. However, the film of the control sample was completely removed.

These results show that films of the copolymers give better acid resistance than the control sample and that the acid resistance improves with increasing amounts of polystyrene glycol in the copolymer.

ALKALI RESISTANCE: Glass panels of the samples were immersed in separate 2% solutions of sodium carbonate and sodium hydroxide at room temperature. Panels dipped in sodium carbonate were taken out at a regular intervals of 24 hr, washed in running fresh water, dried, and examined for any visible damages. Films in sodium hydroxide were checked after 30 min in the same manner.

After three days immersion in sodium carbonate, the sample having 35% polystyrene glycol showed loss of gloss and change in color; those having 30% polystyrene glycol were partially cracked. The samples containing 10% and 20% polystyrene glycol were cracked and partially removed, whereas, the film of the control sample was completely removed.

In the case of 2% sodium hydroxide solutions, the sample having 35% polystyrene glycol was partially cracked and those having 30% and 20% polystyrene glycol were cracked and partially removed. The sample with 10% polystyrene glycol and the control sample were completely removed. These results reveal that alkali resistance increases with increasing amounts of polystyrene glycol in the copolymer.

SOLVENT RESISTANCE: Films of the samples on glass panels were dipped in xylene at room temperature. Film condition was observed at regular intervals of two days. Panels were taken out, allowed to stand in a vertical position for 5 min and then rubbed with cotton wool soaked in xylene. After 10 days of immersion, the sample having 35% polystyrene glycol showed slight loss of gloss; those having 30% showed loss of gloss and change in color. Partial cracks were observed in the case of samples with 20% polystyrene glycol. The sample with 10% polystyrene glycol cracked and was partially removed, whereas, the control was completely removed. These results showed that solvent resistance of the copolymer gradually increased with increasing amounts of polystyrene glycol in the copolymers.

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Dr. Agarwala's previous research work concentrated on the synthesis of functional polystyrenes and their application in the development of various surface coatings. She is currently working on the synthesis and modification of styrene-maleic anhydride copolymers for water-borne coating systems. She has published 12 research papers in various national and international journals and has presented 20 papers in various conferences, seminars and symposia. Dr. Agarwala has received the "Japuria Award" of Oil Technologists Association of India.

SUMMARY

This study indicates that in alkyd preparation, phthalic anhydride can be conveniently replaced by aliphatic acids such as adipic acid and polystyrene glycol gaining advantages of the polystyrene moiety. Use of polystyrene glycol gives better adhesion, gloss, and resistance to various reagents. The incorporation of polystyrene glycol and adipic acid does not significantly affect the resistance of films to water, acids, alkalies, and solvents because copolymers show better film properties.

It can be concluded by the successful use of adipic acid during alkyd preparation, that all these reactions are in close agreement with Flory's concept of *Equal Reactivity*. The use of polystyrene glycol and adipic acid during the preparation of the alkyd resin provides a new approach for synthesis of nonphthalic alkyds with a polystyrene moiety. The use of conjugated fatty acid / oil is not necessary for synthesis of copolymers as is necessarily required in conventional styrenated alkyd. In view of their properties, these copolymers can be closely related to styrenated alkyd already well known in the surface coating field for their better performance.

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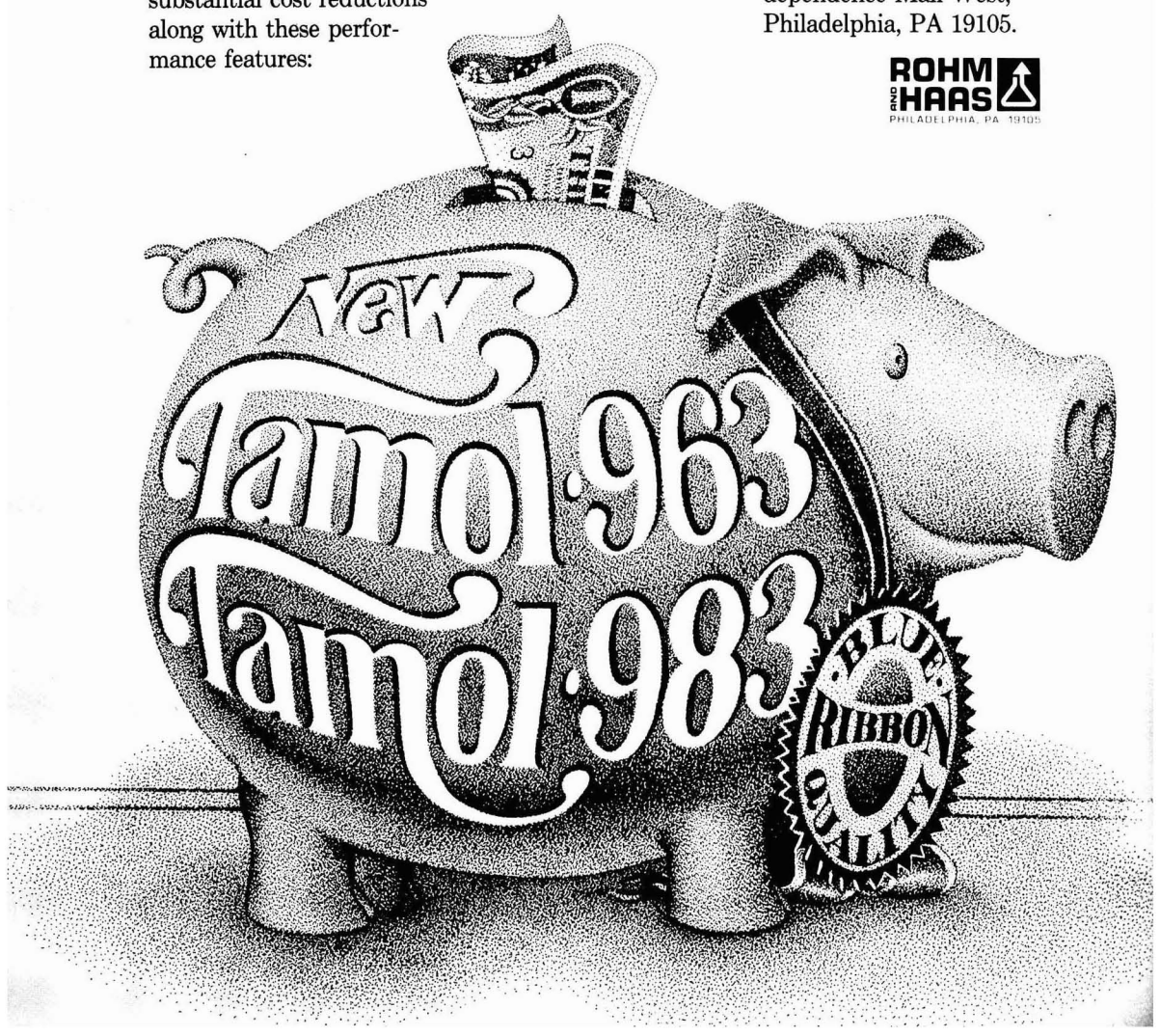

Computerized Process Control In the Manufacturing Process

J. Patrick Kennedy
Oil Systems, Incorporated*

All formula based manufacturing processes have potentially very large payouts from consistency, quality, throughput, and elimination of errors. Proven techniques for automated production can generate large returns. This paper deals with the practical task of reducing this technology to practice and profits; primarily developing a reasonable definition of a project that fits the support capabilities and budget of small companies.

Introduction

Many products in this country are produced from a recipe by plants that are a series of parallel or serial unit operations. This includes paint and coatings, food, pharmaceutical, insecticides, specialty chemicals, catalysts, oil additives, grease, and others too numerous to mention. Although these plants have long been prime candidates, the practical problems of complexity, fragmented industries, and the current economy have prevented widespread use of computer control technology. This has been fortuitous in a sense, because the software technology has lagged the equipment technology and would have caused many failures and unprofitable installations. Unfortunately, the experience these installations would have provided is also missing—particularly in the area of deciding what should be done in specific installations for the highest profit.

Most process computers are designed to perform continuous control algorithms such as flow control and ratioing; but manufacturing tends to be primarily sequential in nature. A few vendors have offered software packages for sequential control and others have developed systems for logical operations (AND, OR, NOR, etc.), but any application of computers for plant control still requires a large amount of custom programming in addition to the configuration of these packages.

The purpose of this paper is to describe the system requirements for a formula based manufacturing process. There is some discussion of the basic software concepts, but no details of programming are included. There are, as yet, no accepted standards for industrial software, but computerization of batch manufacturing processes can be reduced to a manageable engineering task.

Since most plants in the U.S. and abroad will consider computerization as a means of improved productivity, it is probable that many plants will develop projects, and some of those will actually implement systems. Many of those systems will be unquestionable financial and technical disasters; perhaps the old IBM slogan "THINK" is more true today than ever because the reasons for these failures will be software reliability, which translates directly into a lack of standards and engineering practice when dealing with software based engineering projects.

Sequential Control Software

Requirements for reliable and maintainable software to perform sequential control functions have been elusive due to the hidden complexity of the information flow during the manufacturing process. There are numerous pieces of data that are read and/or altered by the various tasks. Maintaining data consistency while expanding function is possible only when the initial design supports expansion.

There are numerous categories of programs that must be specified before the system programming can begin. With software, it is impossible to evolve a design; if one tries, a newly discovered requirement in the latter stages will force the programmers to "patch" the code or start over and double the work or, eventually, both. Full program definition and data base design must precede any coding; thus to develop a successful system, the complete scope of the project must be designated even if it is only partially implemented.

In this section, three major areas of control definition are discussed: (1) recipe handling; (2) batch documentation; and (3) task structure.

In every application, these programs will exist to a greater or lesser degree and provision must be made to accommodate them and their data base access. A design problem arises when a data structure is defined for a particular program, e.g., the sequence executive, and later must be expanded to include new functions, e.g., batch documentation. Unless modern data base access methods are used and data redundancy avoided, the piecewise approach will lower the software reliability of an application. As a field of engineering, software design is new, but strict observance of available methods is mandatory.

The approach for each module is the same, one first determines the functional requirements and then refines the design until every aspect is totally defined for a programmer to implement. In most of

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Table 1—Typical Steps for a Reactor

FILL
DUMP
OPEN
SAMPLE
CHARGE
HEAT
COOL
MIX
EMERG
SPARGE
PRESSURE TEST
HOLD
WASH

these plants, there will be engineers and chemists that can program; but if the design is so loose that it takes an engineer to program the sequence, the systems will always be maintained by engineers.

A word of caution—in many places the term "software" is used and refers to coding the computer. It is unavoidable that the computerization of a plant involves a significant amount of computer programming. The use of packages, fill-in-the-blanks systems, or configurable rather than programmable devices does not change this fact. It is a far better tack to admit that this is software than to try to hide the fact that the system is programmed.

Recipe Data Base

In a typical plant, the recipe is a combination of formula cards, rules of thumb for formula changes, equipment idiosyncrasies, and operator experience. Software specification and design forces one to define, in an unambiguous fashion and with a unique designation, the procedure for making a product. A recipe is a set of data that totally defines all of the actions that must be accomplished to manufacture a product.

The typical recipe is initially composed of steps that could be implemented in many different ways in different units. For example, a FILL instruction could require turning on a pump and opening a solenoid valve in one case and ramping open a control valve in another. It is desirable to design the recipe data base so that a single FILL step can be used for both of these cases. This will make the coding more efficient, but it is done for better reasons. By having a single FILL step, it will be easier to maintain the software. For example, if a new vessel with a third kind of filling system were added, one need only define the FILL operation and all of the recipes would then work for the new unit.

Table 1 is a list of typical steps; the number of elemental steps that are equipment dependent can vary widely. There are plants that have a number of identical parallel reactors, e.g., PVC polymerization, and others that are a series of units with material flowing from vessel to vessel, e.g., plasma fractionation. The recipe data structure should match the structure of the application.

There are many different batch processes in the paint and coatings industry. The manufacture of paint tends to be a fairly simple mixing operation with several units, but the recipe will be complex because of the number of manual operations such as inserting rework material into the product and alteration of a batch because of a chemical or color test. Alternatively, resin manufacture is a more straightforward system that will have only a fraction of the recipes and designed to produce large quantities of quality product. The recipe design, however, will be nearly the same, but separate parts will be more or less extensive. The paint plant will have a much larger and more complex recipe file but only a few steps, whereas, the resin plant will have only a few recipes but a large number of steps. From the standpoint of software design, the complexity of these tasks is identical.

A second point to consider in the design of the recipe is the proper modularization of the software. A resin reactor seems very modular to a plant engineer. It is physically isolated and is the most important part of the process. It is, however, one of the least modular parts of the plant. It must interact with the raw material tanks, operator, product tanks, utilities, and nearly everything else. A product storage vessel, on the other hand, is quite modular. Consequently, a project to initially computerize the resin reactor alone is doomed to failure because it truly is not modular from an informational point of view.

The recipe is composed of data which includes the steps and parameters for each step, flags that indicate the status of different operations and units, text and operator instructions, setpoints and other parameters, emergency responses, recovery procedure, etc. The master recipe is generally kept on a system storage device and when it is to be made, a copy is brought into the machine. Certain personnel are allowed to make changes and each change is documented in batch record. Usually this change will not affect the master recipe. This active recipe will now form the basis of the manufacture and documentation of the material.

Figure 1 shows a simple batch process with four feeds and a temperature control loop. This unit typifies many industrial units. *Table* 2 shows two possible formulas. In this example, all formulas were represented by a fixed sequence of steps; charge 1, charge 2, ramp temp, hold, and done. This is not normally the case, but it makes the sequence logic easier to follow because the step type was *not* a recipe parameter. This is a good

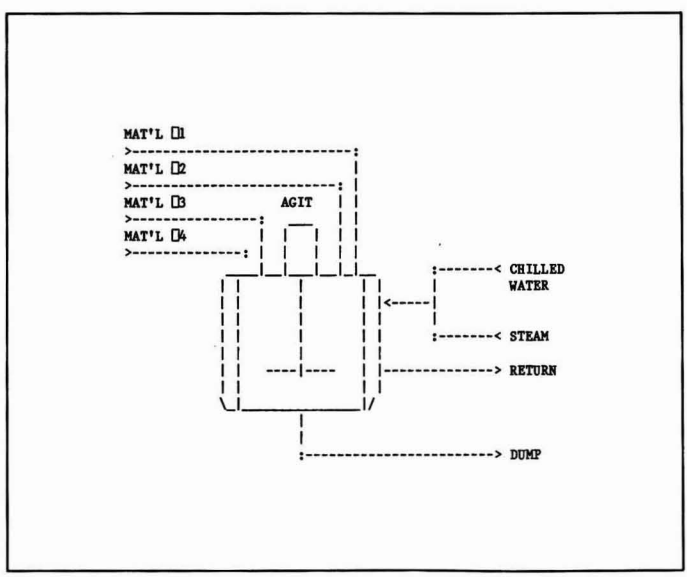

Figure 1—Sample batch process

example of why it is necessary to design for the maximum scope desired. If this were a real installation and, in the future, an example which had a different sequence of steps needed to be produced, all of the software would have to be rewritten.

Figure 2 shows a portion of the Mainline Sequence for the example. This and the information in *Table* 3 completely specify the procedure for making the products. *Table* 3 shows a listing of what a recipe looks like for a computerized system. This is markedly different from what is considered a batch ticket or recipe card, although it can be derived from a combination of recipe data and the sequencing steps. The other difference is the preciseness with which a recipe must be specified. In even this simple example, when the temperature was raised or lowered, the rate at which the temperature is ramped and the maximum expected time are specified. Since computerization forces one to tie down these types of variables, there is usually a substantial increase in quality, consistency, and yield reported from fully automated facilities. In addition to specifying the recipe, an automated system controls, in a consistent fashion, the time at which things are done. This fixing of the time base is a leading reason for consistent results.

Table 2—Two Sample Formulas for Process Shown in *Figure* 1

FORMULA #1

(1) Charge 500 gallons of material #1 into the vessel
(2) Turn on the agitator and add 800 gallons of material #2
(3) Stop the agitator
(4) Raise the temperature to 300°F.
(5) Hold the vessel at this temperature for 20 minutes
(6) Lower the temperature to 70°F.
(7) Put the vessel to manual and request dump

FORMULA #2

(1) Charge 700 gallons of material #2 into the vessel
(2) Turn on the agitator and add 200 gallons of material #1
(3) Turn off the agitator
(4) Raise the temperature to 200°F.
(5) Turn on the agitator and add 600 gallons of material #3
(6) Stop the agitator and raise the temperature to 450°F.
(7) Turn on the agitator and hold at this temperature for 30 minutes
(8) Lower the temperature to 70°F.
(9) Put the vessel to manual and request dump

Batch Documentation

The records of how a material is made is critical to evolving quality products and is, in some cases, required by law. One advantage of a computerized process is the ability to document the manufacture of a product by keeping records only of the exceptions to the recipe. These data are particularly useful if, at some time in the future, an anomaly is noted (either good or bad). The batch documentation will have a record of what happened out of the ordinary on that particular batch. If the process goes to manual, these records must then be kept by hand. This is an excellent means of encouraging the operators to keep the system on-line.

Table 4 is a list of typical entries into a batch record. From these data and the recipe, much information can be readily accessed. Off spec material caused by equipment malfunction or operator error is largely eliminated and the amount of material in a recall is minimized.

Task Structure

Although the amount of software required for a batch sequencing application may seem large, it is necessary for the engineers and designers to handle all of the "corners" (abnormal responses, initializations, recovery operations) to make the system easy to use for the operators. The percentage of uptime is directly correlated to the ease of use. A system that is not used will detract from an operation and be a financial loser.

Figure 3 shows the grid of application programs required for an application. The system initialization functions allow operations personnel to start the system on automatic regardless of the reasons for being off-line. Some of the reasons are equipment failure (both computer and plant equipment), emergency conditions, routine maintenance of the computer, and manual removal of the system from on-line. Every plant will have a manual operation mode and the panel recovery is the transfer of the system from manual operation to automatic; this includes both the panel initialization and P->C transfer logic. In most plants there are multiple panels and different recovery programs for each unit.

The plant automation software contains the programs that most articles in the literature discuss and are an important part of the system. The scheduler program is a step up from the logic in that it schedules production through the plant. Many times other software, such as order entry and raw material and product inventory programs, are interfaced to the automation software. These interfaces are normally through the data base and need to be included in the initial design.

Documentation has already been discussed and, in addition, there may be other programs such as a Data Archive Program to provide plots of plant data and batch information.

Even though batch sequencing is mainly an asynchronous (triggered on events instead of time) process, there are still several tasks that run on a synchronous basis. These include the control or loop processors that actually do the temperature, pressure and flow control, and the monitors. The monitor is an important concept in batch control. These are simple routines that check the integrity of the process subsystems that must be functional such as the cooling water, raw material levels, header check, etc. They maintain status flags and these are checked before, during, and after a batch. In this way, a batch is not started if there is not sufficient raw material or cooling; or if a charge pump fails in the middle of a charge it is caught by the monitor. In a typical computerized plant, more safety checks are done every hour than in a manually operated plant in its life.

In addition to the aforementioned programs, there are also numerous asynchronous programs that are used. These procedures respond to an event such as a switch transfer for the P->C logic. The most important of these are the failure responses and the operator interface. The failure responses are different for each process, but they should be designed so that the response is not worse than the failure itself. Computers have a unique failure mode; at one time it was considered a disadvantage, but is now generally recognized as an advantage in a well engineered system. If anything works in the processor, then, everything works. The converse is also true, when a computer fails, it ceases to function totally. It is much easier to design a backup system for a computer system than a relay panel

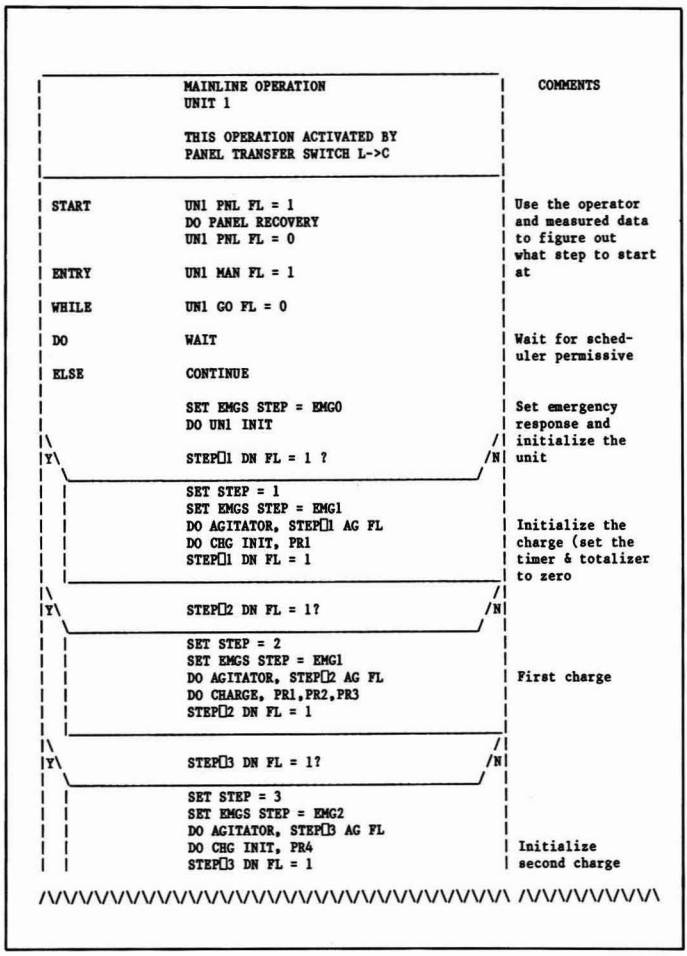

Figure 2—Partial listing of the mainline operation

with 1000 relays of which four do not work. Since the computer must be up whenever the emergency logic is encountered, the logic is designed to cause minimum disruption in areas not affected by the failure, plus allow easy restart. During the startup on a world class PVC plant, one of the charge pump seals began to leak. The backcheck monitor was comparing the drop in monomer level with the increase in rector level and the rotations of the charge pump (a PD pump) and the rotations of the oval meter. The pump pumped foam and the meter counted foam and the reactor level increased, but the monomer tank did not drop sufficiently. The unit went into emergency status, the operator isolated the problem and charged more monomer manually (through the computer) and continued the batch. Clearly, over the life of a plant, the emergency detection is a valuable addition. In many batch cycles, a problem such as described above may go undetected for years and result in product quality variations.

The other critical asynchronous procedure is the operator interface. Several different methods have been tried and there is no clear answer for this problem. One commonality, however, is that there is much more information that an operator needs in a batch process compared to a continuous process. Anything that increases the speed and density of the information is good and CRT displays that are difficult to access or have only a little pertinent information are inappropriate.

Installations

There are only a few reported installations of computerized batch processing in the paint and coatings industry in this country. There has been some work on the automation of resin facilities, including epoxy resins. In the area of pipe resins, there have probably been more large PVC plants computerized than any other single batch process.[1] These plants are totally automated; the operator need only select a recipe and issue a single command and eight hours later the PVC drops out of the recovery section into the product hoppers. Lately, there have been two reported experiences in the paint industry, one in paint manufacture and one for alkyd and acrylic resins in the same reactor.[2,3]

Outside the paint industry, there have been several installations in which computer control has been used very successfully; the pharmaceutical industry for penicillin production and other batch fermentation processes, the oil industry for production of catalysts and specialty chemicals, the food industry for cooking retorts, the metal industry for soaking pits, the paper industry for batch digesters. The batch control software technology for all of these is very similar to paint manufacture. The chart in *Figure* 3 could be used to describe any of the processes above.

Conclusions

The economics of computer control have been highly variable. Some installations report almost unbelievable improvements in operation. In the case of PVC, reports from several different sources[1] indicate that the computer can produce approximately twice the product as the manual system. This has been repeatedly verified in plants that routinely run on manual for operator training once per month. In other cases, there are examples (usually unreported) where the computer has been a devastating drain on finances and patience without any positive impact on the plant economics. In the analysis of these cases, the conclusion of the author is that the difference is in the front end design of the software. All programs generally perform as designed, but the latter are cases of systems incorrectly designed.

There are several areas of reproducible benefit from the successful systems. These are in the areas of throughput, quality, and productivity.

The throughput of a batch facility is almost totally a function of batch cycle time. There are two ways to decrease this time, the idle time between batches can be reduced and the procedure can be

Table 3—Recipe Parameters for Example

RECIPE PARAMETERS

PR#	NAME	FORMULA #1	FORMULA #2
1	CHARGE #1 MATL	1	2
2	CHARGE #1 AMT	500	700
3	CHARGE #1 MAX TIME	20	20
4	CHARGE #2 MATL	2	1
5	CHARGE #2 AMT	800	200
6	CHARGE #2 MAX TIME	20	20
7	RAMP #1 TEMP LOOP	T100	T100
8	RAMP #1 RATE (DEG/M)	2	2
9	RAMP #1 FINAL T	300	200
10	RAMP #1 MAX TIME	60	40
		.	.
		.	.
		continued	

RECIPE FLAGS

FL#	NAME	FORMULA #1	FORMULA #2
1	STEP #1 AG FL	0	0
2	STEP #2 AG FL	0	0
3	STEP #3 AG FL	1	1
4	STEP #4 AG FL	1	1
5	STEP #5 AG FL	0	0
6	STEP #6 AG FL	1	0
7	STEP #7 AG FL	0	1
		.	.
		.	.
		continued	

Table 4—Typical Entries Into Batch Record

BATCH RECORDS

Operator initials
Supervisor Initials
Deviations from Setpoint
Alarms
Device Failures
Laboratory Results
Changes in Active Recipe
Operator Override of Computer
Timeouts
Operator Comments
Raw Material Serial No.
Recipe No.

changed to save time. In the former case, one must eliminate whatever manual operations are needed, otherwise operators will be reluctant to start two batches simultaneously or before shift change. In the case of the recipe, simple elimination to the waits for operator actions was worth a 30% increase in the throughput of a dye beck operation. The procedure itself can also be changed. In PVC production, simultaneous charging of material and pressure leak testing with every batch is common.

Quality is dramatically improved in a batch operation by eliminating the inconsistency between batches; this also increases throughput and reduces material and disposal costs. Most of these inconsistencies are caused by manual control. Consider the simple instruction:

"Raise temperature to 75 C and mix NLT 45 min."

In a computerized plant, the equivalent would be:

"Raise the temperature to 75 C at 2.0 deg/min and then mix at 75% speed for 52.5 min."

The rate at which the temperature was changed and the exact time and speed for the agitator were not specified and it was left to the judgment or inclination of the operator. Encountering this step one-half hour before shift change and one-half hour after shift change would produce different material. Although these differences are small, it appears that they accumulate. The second means of improving quality is the total elimination of errors and faults, causing proper response to equipment malfunctions and automation of manual procedures.

The increase in productivity are clear. In the case of a batch plant in Texas compared to the same capacity plant in Ohio, the number of operators on the grave-yard shift (12 to 8 am) was reduced from 25 to 6. In addition, the skill level of operators is declining and risks from exposure are discouraging long term employment in this area. With many types of chemicals, totally closed operation will soon be the standard.

The most remarkable facet of the economics is that it does not take complex and expensive new analyzers or dispensing equipment to justify computer control and, in fact, these add uncertainties that can reduce the expected value of a project. The most dramatic improvements come from simple automation of as many of the tasks as practical and leaving the rest to an operator. In the case of the dye becks, there were 1700 different formulations for the dyes and some materials were used in very small quantity. The system would print out in the color room the proper recipe and wait until the operator attached a mixing vat with the dyes. The computer would sense, via limit switch, the vat and initiate the chemical charge. It also, however, antici-

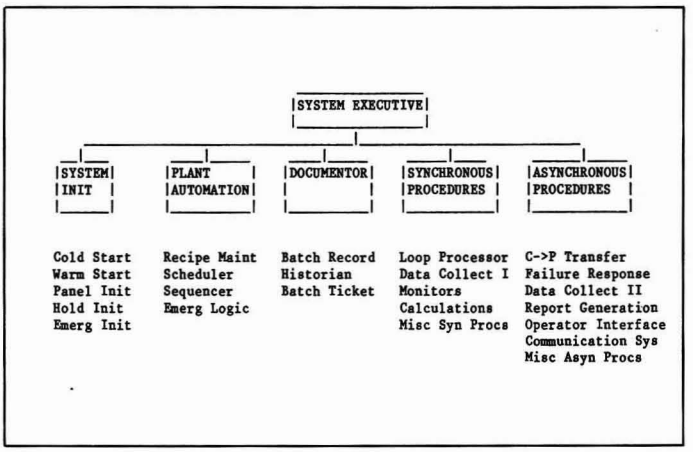

Figure 3—Overall batch software structure

pated the need for different chemicals, ratioed the proportion from the recipe, and documented when the colors were off. Some systems in Europe went to more automated use of color analyzers with success, but the important point is that the payouts for the computerization were standalone and did not require analyzers.

The paint industry is unique in that it is dominated by the small company with only a single plant. It does not seem likely, then, that the evolution of computerization will progress at the same rate as in the industries mentioned above. There is a secondary problem in that there is a definite lack of standards in this field. Consider the unanswered questions:

(1) What is needed for operator interface?

(2) What are the documentation requirements?

(3) What interface is correct between the computer and instrumentation, analyzers, programmable controllers, and electrical requirements?

(4) What are the environmental and electrical requirements?

(5) How is software quality tested?

(6) What are the software standards?

(7) What manual system is necessary and how is the transfer from computer and panel designed?

These questions are all still answered on a per job basis which leaves room for error.

The inescapable conclusion is that this industry needs to utilize advanced technology to remain competitive and reduce complexity and costs. It must look to other industries to find the standards and practices as well as the expertise.

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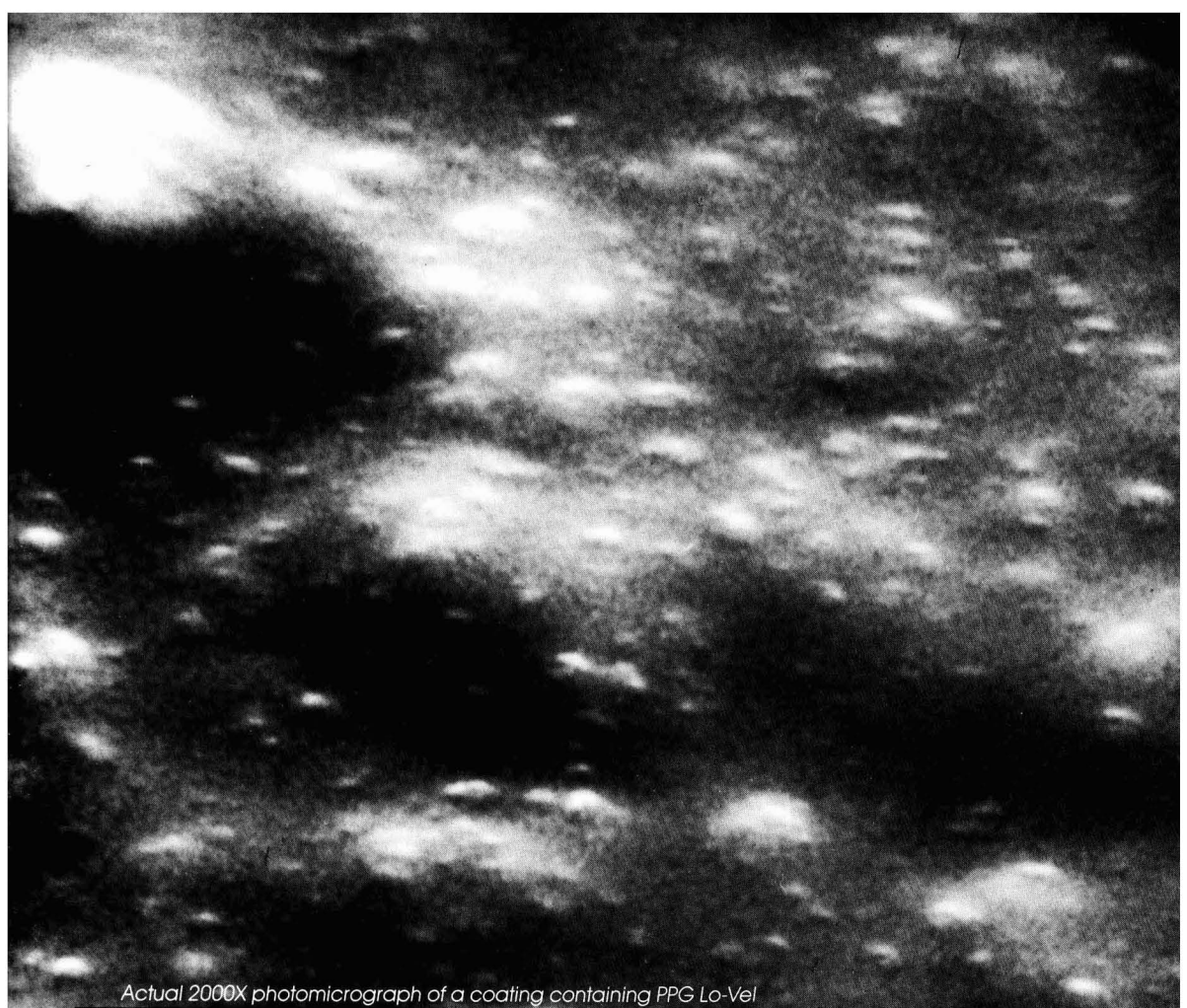
Errata

In the article, "Towards Environmentally Acceptable Corrosion Protection by Organic Coatings. Problems and Realization," by Werner Funke (October 1983, pp 31-38), an error was published in the Conclusion. The copy should read (correction italized):

> In developing new corrosion protective coatings from paints, the barrier principle is a promising way to obtain good corrosion protection, which is at least equivalent to that of conventional systems and also satisfies the demand for environmentally acceptable solutions.
>
> With pigment substitutes, which simply replace classical anticorrosive pigments, this goal is scarcely attainable. Rather, a complete new formulation of paints is necessary. The guideline is to decrease water- and oxygen permeability as much as possible and to *provide* the water resistant adhesion of the coating to the substrate. These aspects are the same for decreasing undercutting and underrusting of injured coatings.



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Cyanoacrylate Adhesives— A Day of Serendipity, A Decade of Hard Work

H.W. Coover
Eastman Kodak Company*

Introduction

The dictionary defines serendipity as the gift of finding valuable or agreeable things not sought for—to put it more simply, a lucky accident. But it's not quite that simple. The same accident which is lucky for one may be unlucky for another. You have to be ready to see the luck in the accident, to grab it, and be willing to work to turn the luck into success. Serendipity certainly played a large part in the discovery of cyanoacrylate adhesives but only when my mind was finally ready to see that the accident was really a bit of luck.

Come back with me to the days when I was a young chemist at the bench. The time, World War II; the place, the Kodak Research Laboratories in Rochester; the problem, to find an optically clear plastic from which precision gunsight lenses could be cast. I was working with some acrylate monomers which showed promise except for a recurring problem—they stuck to everything they touched. But, I didn't see this as serendipity. I was thinking gunsights, and nothing but gunsights and the adhesive qualities of these monomers were a serious obstacle in my path. The end of the war brought this project to an end. I forgot the stubbornly-sticking acrylates. Serendipity had knocked, but I didn't hear it.

The Second Chance

Now let's move ahead a few years, travel a few hundred miles south, and back away from the bench a few steps. The time, 1951; the place, the research laboratories of the Tennessee Eastman Company; the problem, to discover stronger, tougher, more heat-resistant acrylate polymers for jet plane canopies. I was now supervising a new crop of young chemists who were investigating the properties of acrylate polymers related to those I had been working with at Kodak. The acrylate monomers with electronegative substituents were difficult to make, even more difficult to purify, and still more difficult to analyze for purity.

One of my group, Dr. Fred Joyner, prepared what he thought was a pure sample of ethyl cyanoacrylate and decided to measure its refractive index to characterize its purity. He put a thin film of this monomer between the closely-fitting faces of the two prisms of an Abbe refractometer. After the measurement was made and recorded, Fred was unable to separate the prisms. He took his problem to his laboratory supervisor, Dr. Newt Shearer, but nothing they could think of freed the prisms. Finally, Fred and Newt came to me to report that they had ruined a $700 instrument. Any concern I had about the refractometer was swept away by the sudden realization that what we had was not a useless instrument, but a unique adhesive. Serendipity had given me a second chance but this time the mental process led to inspiration.

Immediately I asked Fred for a sample of his monomer and began gluing everything I could lay my hands on—glass plates, rubber stoppers, metal spatulas, wood, paper, plastic—in all combinations. Everything stuck to everything, almost instantly, and with bonds I could not break apart. In that one afternoon, cyanoacrylate adhesives were conceived, purely as the result of serendipity.

Why was this accident serendipitous when previous experiences with acrylate adhesion had not led to inspiration? Several things came together in just the right way. The sample was the purest ethyl cyanoacrylate we had prepared, free of traces of stabilizing substances which retard or prevent polymerization. The refractometer prisms provided the perfect bonding situation—two closely-fitting surfaces with a very thin layer of cyanoacrylate spread evenly between them, which, as it turned out, was a necessary condition for strong bonding. Finally, and perhaps most important, the problem of separating the prisms, which greatly

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concerned my worried colleagues, wasn't really my concern. Being free of direct impact of the unfortunate aspects of the affair, I was more receptive to the potentially fortunate outcome. It may be that this mental condition is the gift in serendipity.

The cyanoacrylate adhesives provided an entirely new way to bond materials. Most adhesives are applied as viscous, sticky materials. A relatively thick layer of adhesive usually results from their high viscosities, and bond formation often requires a fairly long setting or curing period. In contrast, cyanoacrylate adhesives are free-flowing liquids which spread readily into very thin layers and then polymerize in place to form strong bonds. Indeed, the best bonds are obtained when the adhesive layer is substantially less than 1 mil thick. Polymerization occurs extremely rapidly so that strong bonds are formed in a few seconds, although the bond strength continues to increase for some time. These properties allow bonding intricate parts with a minimum of adhesive and without elaborate jigs and clamps. They form strong bonds with metals, plastics, rubbers, ceramics, hardwoods, and other relatively nonporous materials. Soft woods or porous materials absorb these fluid adhesives and are generally unsuitable for bonding. However, proper surface preparation or special formulations overcome this problem.

The Hard Work

I wish I could say that these properties made the cyanoacrylates an instant success and that serendipity plus my one afternoon's work led immediately to commercialization. Innovation is never that easy. A great deal of fundamental laboratory work still remained to overcome the obstacles between scientific discovery and technical success.

Because our adhesive polymerized in place, we had to gain a knowledge of the mechanism of polymerization and the effect of structure on polymerization. The mechanism was found to be anionic, catalyzed by minute traces of water or other weak base adsorbed on the bonding surfaces. Almost all solids have sufficient adsorbed water to initiate polymerization. Once initiated, polymerization is almost instantaneous. This mechanism requires two strongly electronegative groups substituted at one end of the carbon-carbon double bond which is the actual polymer-forming structure. The lower alkyl esters of cyanoacrylic acid, where the electronegative groups are the cyano and carboxylate ester groups provided the best overall properties. Serendipity had led us to the right monomers from the beginning.

But, how could these be produced commercially? New procedures had to be developed to produce them on a larger-than-laboratory scale. For a volatile, highly-reactive monomer, stabilization and packaging to provide reasonable shelf-life were serious problems. These too were overcome. We had a process, a formulation, and a package all acceptable for commercial use. We also had a good patent position. Eastman 910® Adhesive was introduced as a commercial product in 1958 after one serendipitous day and seven years of hard work.

We found that there was still one more roadblock in the path to business success. The world did not seem to be waiting for this new super adhesive. Sometimes a product fills a need which nobody realizes he has. The solution was to convince a few people they really did need a cyanoacrylate adhesive. We demonstrated Eastman 910 adhesive to anyone who would watch, even having Gary Moore and I suspended before a nationwide TV audience by a drop of cyanoacrylate glue. These demonstrations paid off and interest in this new adhesive began to come from potential users.

Our first sale was to Mason and Hanger for an assembly job in an atomic bomb. They liked the product and it performed well. Other sales followed until cyanoacrylate adhesives found application in such varied products as cameras, electronic equipment, automobile parts, and sporting equipment. In the 25 years since the introduction of Eastman 910 adhesive, other domestic and foreign producers of cyanoacrylates have entered the market with products for industrial and home use. The market has grown to about one million pounds and many millions of dollars in sales per year. Considering that the average bond takes one drop and that there are about 30,000 drops per pound, one million pounds will make some 30 billion individual bonds. Cyanoacrylate adhesives are now recognized as most useful industrial and household adhesives.

Serendipity in Reverse

Now let's look at another chapter of the cyanoacrylate story, cyanoacrylate medical adhesives. This is a tale of serendipity in reverse—the gift of being presented with unfortunate outcomes not sought for. This gift seems to be especially associated with government regulations.

Doctors have long dreamed of a tissue adhesive, a glue which could be used to mend human flesh without the complications of sutures or other mechanical fasteners. All attempts to find a physiologically acceptable surgical adhesive had failed, sometimes with disastrous results for the patient. Still, surgeons dreamed of the impossible procedures that might become possible if only such an adhesive could be found.

In the late 50's it occurred to me that the cyanoacrylates might provide just such an adhesive. I knew that methyl cyanoacrylate would form a strong bond with human skin, some of our scientists had unintentionally demonstrated that. Perhaps it would bond other tissue as well.

Because Eastman had no facilities for medical research, in 1960 we entered into a cooperative agreement with Ethicon, a subsidiary of Johnson and Johnson, to investigate possible medical applications of the cyanoacrylates. A number of outstanding medical research groups were involved in these investigations. Much more complex in every way than the development of Eastman 910, this work went on for more than a decade. Many tough problems had to be solved. The original methyl cyanoacrylate proved to be toxic to tissue. But longer-chain analogs such as butyl or isobutyl cyanoacrylate were much more tolerable. The methods used to apply Eastman 910 in industrial uses were not useful in surgical procedures. Suitable methods for applying cyanoacrylate to living tissue were developed, including an ingenious disposable spray applicator. Improved methods for packaging these reactive adhesives had to be developed that would enable sterilization. Formulating to meet exacting performance requirements was a challenging problem to solve. Through experiments with laboratory animals and, later, in actual use on human subjects, the value of the cyanoacrylate medical adhesives was established.

In brief, some of the medical problems for which the cyanoacrylates proved uniquely useful are these. Sutureless surgery, particularly rejoining veins, arteries, or intestines was indeed possible with the cyanoacrylates. They were equally useful in sealing and reinforcing suture lines in more conventional procedures. In ophthalmic surgery, these adhesives readily sealed small punctures or lesions in the eyeball, ordinarily very difficult to do, with sight-saving results. Corneal transplants were made safer and easier to perform. In cosmetic surgery, the use of cyanoacrylates to replace or supplement sutures, greatly reduced scarring. Bleeding ulcers could be sealed with a coating of adhesive which protected the ulcer from stomach acids while healing proceeded, a procedure which could be accomplished through an endoscope without surgery. Repairs of soft organs, lung lesions, and other serious

damage could be more easily done with these adhesives than by conventional methods.

Cyanoacrylate adhesives were particularly useful in dental surgery in sealing tooth sockets after extractions and in periodontal surgery. An unexpected bonus in periodontal surgery was that cyanoacrylate greatly reduced the postoperative pain suffered by the patient. In all of these operations the adhesive made the work easier and quicker for the surgeon, reduced the stress on the patient, promoted rapid recovery of function or appearance, and sometimes, made possible otherwise impossible repairs, thus saving lives.

Probably the most unusual and valuable use of the cyanoacrylates was as hemostatic agents, a use which departed somewhat from the original concept of a tissue-joining adhesive. Uncontrollable bleeding is a serious problem in surgery, particularly in the repair of soft organs such as the liver or spleen. It was found that a thin coating of cyanoacrylate sprayed on the bleeding surface almost instantly stopped the loss of blood. This was truly a lifesaving procedure for it controlled bleeding when all other measures failed.

The ultimate test for cyanoacrylate medical adhesive came in the Vietnam War. Medical evacuation helicopters brought the seriously wounded to battlezone surgical units, sometimes within minutes after injury. Once there, all too often even the most skilled surgeon could not save many of those suffering grave wounds of the chest or abdomen. Uncontrollable bleeding killed them before the damage could be repaired. In 1966 a special surgical team trained and equipped with cyanoacrylate adhesive went to Vietnam and experienced almost miraculous results. A simple spray stopped the bleeding almost instantly allowing time to treat the wounds by conventional means. Because of cyanoacrylate, many were saved who would otherwise have died. A revolutionary advance in surgery seemed to be at hand. But it was not to be in the United States, although Europe and Japan have reduced to successful practice the medical uses developed by our research teams. Technology had succeeded, but federal regulation was about to cancel that success.

FDA Says No

The first application for new drug approval went to FDA in 1964. Over the next six years cyanoacrylates were tested and retested for safety. Every time approval seemed to be almost in hand FDA changed their standards and requested new data. Each time retesting affirmed the safety and efficacy of the cyanoacrylate. Finally, the only concern was about possible carcinogenicity of the cyanoacrylates. The FDA proposed a third long-term, very costly study which might answer their objections. Ethicon, and we faced a dilemma. The cost of this study would exceed the revenues for cyanoacrylates for years to come. On the other hand, the need for this unique lifesaving adhesive was great. After much agonizing, it was finally concluded that the proposed multi-million dollar study was not an attractive gamble. This was based on the fact that there was no assurance that FDA would not propose a fourth carcinogenicity study and the general belief that there was little chance of obtaining approval even if the results were entirely favorable because of this cancer concern.

What was the evidence for carcinogenicity? Only this—solid cyanoacrylate polymer disks implanted in rats, but not in other animals, caused tumors, some of which were malignant. Not only did this test in no way approximate actual use of the adhesive, but rats were known to react in this way to implants of almost any insoluble material that blocks fluid flow—nearly all plastics, metals, ceramics—including many materials used routinely in prosthetic devices give the same effect. Neither humans or animals treated with cyanoacrylate applied under normal surgical conditions developed tumors. But the questions raised by the rat implant tests were enough to prevent approval. Today, in the United States, an occasional Investigational Drug Permit is issued allowing the limited use of cyanoacrylate in special circumstances. A few surgeons risk using nonmedical cyanoacrylate without approval, purchasing industrial grade adhesive or even consumer adhesive. If you could choose for yourself, I am sure you'd accept a small risk of cancer in ten years or twenty years over bleeding to death on the operating table. But FDA allows no choice. By 1972, after twelve years of technical success and a record of saving lives, the cyanoacrylate medical adhesive was, for all practical purposes, dead.

In the part of this work that was carefully planned, we were not successful in achieving our goal. The part of the story that started with the serendipity associated with the refractometer resulted in a useful product with which nearly everyone is familiar. This should serve as a reminder to all of us to be open-minded and curious enough to pursue unexplained events and unexpected results which may unlock new secrets and lead to the new and exciting discoveries of the future.

Open Forum is an experiment in communications designed to give readers the opportunity to share creative concepts in all aspects of coatings. Suggested topics include color, formulation and manufacture, testing, and selection of raw materials. These "tricks of the trade" need not be prepared formally such as research papers, but should, however, be thorough in their preparation and presentation. Submissions should be sent to "Open Forum" Editor, Journal of Coatings Technology, 1315 Walnut St., Philadelphia, PA 19107.

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Safety Net

Each year the American manufacturing industry begins a new tally for the U.S. Department of Labor. This statistical category is posted in plain view in most every plant in the country, is marked in managers' and superintendents' ledgers, and is digitalized and analyzed in company computers. Its net effect on the country's economy is determined, and reports, scorecards if you like, are issued yearly for the various industries. The numbers are punched and pulled, twisted and shaped, and someone in authority says, "Well, we're doing pretty good. But, let's do better next year."

These numbers are the statistical enumeration of pain and suffering, the number of man-days lost to work-related accidents. If it is an old adage that the pages of safety rule books are written in blood, you can bet that for each rule there was a real life (or death) example.

The coatings industry is no stranger to this story, as JCT Technical Editor Tom Miranda discussed in the July "Comment," in which he asked readers to share their views and experiences in the hope that the coatings industry would benefit through the knowledge of others.

Below, we publish the initial responses on this theme. And we request that others share their thoughts and help weave a safety net to save the industry time, money—and lives.

Safe Operation Of Ball and Pebble Mills

Most ball and pebble mill operators do not follow any safety precautions when loading or draining their mills. Although we issue a "Handbook of Ball and Pebble Mill Operation" with every mill, we doubt that many of the recipients ever read it or follow the procedures for safety.

The most common problem is that operators do not vent the mill after it has been running. Since pressure will build up inside the mill cylinder as heat increases, the vent plug should periodically be removed to relieve that pressure. The larger the mill, the more horsepower required, the greater the heat and pressure build-up, the more frequent the venting is required.

Cooling a mill by circulating water through a jacket over the shell, or dripping water over the shell, will help in reducing pressure build-up, but this does not eliminate the need for venting.

Another aid for keeping pressure down is pull a vacuum in the mill prior to start-up; however, the mill manufacturer should be consulted before this action is taken.

It is practically impossible to "ground" static electricity in a pebble mill because the lining and the grinding media are non-conductive; consequently, it is advisable to purge the mill cylinder with an inert gas before loading or emptying material.

The use of air pressure to discharge a mill is a rather common practice, but too often some operators forget that a standard mill is not a code designed pressure vessel, and use excessive pressure. Paul O. Abbe mills (except jar mills) built within the past 20 years will withstand 14.7 p.s.i.g. internal pressure (when new) without fear of mechanical failure; however, we recommend that no more than 5 to 6 p.s.i.g. pressure be used to facilitate discharging. Greater pressure may actually impede discharging since it may simply "blow through" the discharge outlet and leave material in the mill.

Adding solvents to a mill by pouring them down an inclined pipe can be hazardous, even though the container, pipe, and mill are all "grounded." Some solvents may build up a static charge within themselves when being poured—check with the solvent supplier in this regard.

Ball and pebble mills are still one of the safest types of equipment used in the manufacture of paints, coatings, inks, etc., but even they require some common sense on the part of the operator.

JOHN M. RAHTER
Sales Engineer
Paul O. Abbe, Inc.

Advice to Production Supervisors

Do not get so involved with how many units are being produced so as to ignore the safety and hazard education that you owe to subordinates. Their safety may be jeopardized through inadequate knowledge. This is your responsibility as a supervisor. You cannot assume that employees know all the proper safeways to handle coatings that you may already know, without taking the time to educate them.

Take the time to do it right the first time or someone may not get a second chance at all.

Sometimes in our quest to carry out the bosses orders, we lose sight of our responsibility to the overall operation and may incur unnecessary risk to any or all employees.

ROBERT CROOKS
Chemist
Plasti-Kote Co., Inc.

Unsafe Use of Alcoholic KOH

When I was with a resin manufacturer in the early part of 1981, a chemist was badly burned and later died.

He had made a five gallon solution of alc KOH and was applying nitrogen gas to pressurize the plastic container for easy titration. The alcohol was methanal as is customary. The solution was for the usual acid value determination done while polymers are cooking and after they are finished. A routine procedure.

The container split and the solution spilled. A hot plate apparently set off the vapors and the whole lab went up in flames. With his clothing on fire, the chemist ran out of the lab and past the emergency shower and the fire blanket. A technician coming from another lab saw him and sent him back up the hall where the fire was put out with the fire blanket and an extinguisher.

(Reporting) this incident may help to stop some of the unsafe uses of alcoholic KOH.

TOM KINSELLA
Eggertsville, NY

In the July Issue we asked for contributions from our readers concerning the vital issue of safety. We are pleased to have three submissions from our initial request. The objective is to supply our readers with safety related information which could help prevent accidents, injury, or death.

This type of information does not find its way into the available literature and we hope to serve as a source of safety information from time to time.

If this column is of interest to our readers, we would urge that you submit safety related items to us.

—Technical Editor

June 1983 Subcommittee Reports Of ASTM Committee D-1

The June 1983 meeting of ASTM Committee D-1 on Paint and Related Coatings and Materials was held on June 26–29 at the Hyatt Regency Hotel, Nashville, TN. In the three and one-half days preceding the final report session and general meeting of Committee D-1, approximately 166 members and guests met in 154 scheduled meetings of D-1 subcommittees and working groups. The present membership of Committee D-1 is 504.

Management Seminar on June 28 featured Mr. J. P. Andrews, Vice-President F&FP Dept., E. I. DuPont de-Nemours & Co., as the speaker. His subject was "Management and ASTM."

Special highlights of the meeting were the presentation of the Society Award of Merit to Mark P. Morse and the W. T. Pearce Award to Harry E. Ashton. A memorial resolution was presented on the passing of Ignatius Metil, 25 year member of D-1.

Subcommittee Officer appointment was made: The newly formed Sub. D01.61 on Paint Applicators—F. B. Burns as Chairman.

Highlights

The following projects of major interest to the coatings industry warrant special emphasis:

Masonry Treatments—Subcommittee organizational meeting to be held in December at Bal Harbour D-1 session. Scope to include protection and preservation of dimension stone, brick, tile, concrete, mortar, grout, etc.

Halohydrocarbons in Coatings—Results of Sub. D01.21.55 round-robin on three coatings by 10 labs look good.

VOC Determinations—Sub. D01.21.56's round-robin to determine precision of D 3960 showed good results for solvent-reducible systems, but not satisfactory for water-reducibles.

Occupational Exposure to Water-Insoluble Chromates—Sub. D01.31 will set up a task group to study E-34's E 848, a new standard practice for safety and health requirements relating to this subject.

Government Paint Purchasing—Sub. D01.41 to form new task group on problems of government purchasing agents.

Swelling in Hardboard Siding—Sub. D01.52B planning a round-robin on correlation of rapid wetting tests with test fence exposures for possible prediction of problems relating to surfactants in some housepaints.

Paint Brush Specifications—Newly formed Sub. D01.61 to focus initial efforts on "criteria for state and institutional purchasing of commercial paint applicators."

AD HOC COMMITTEE ON MASONRY FINISHING MATERIALS

Several reports on problems of preserving masonry in historic and government buildings and monuments were reviewed. Problems with painting masonry surfaces were identified, as well as deteriorating factors associated with exterior masonry walls.

After considerable discussion of these various subjects it was recommended that Sub. D01.90 be requested to approve converting this committee to a Provisional Subcommittee on Masonry Treatments with a scope of "Protection and preservation of dimension stone, brick, tile, concrete, mortar, grout, and other generally used materials fabricated and assembled by masons either on-site or prefabricated. Statuary may be of ancillary interest if made of included materials."

The proposed tasks are: (1) Proposed practice to identify problems including test methods of treating masonry; (2) Guide to practice and test methods for block fillers in cement and cinder block; (3) Coating of cement or cement-asbestos to encapsulate loose asbestos; (4) Guide for evaluating performance of treatments used to protect a masonry surface and to determine when a surface should be refinished, including the condition of the surface; (5) Void filling in concrete; and (6) Problems of form release compound usage.

It was agreed that a special organizational meeting be held in Bal Harbour in December in conjunction with the D-1 Winter meeting.

DIVISION 1 ADMINISTRATIVE

SUBCOMMITTEE D01.94 AWARDS AND MEMORIALS

H. K. Hammond III, Chairman

The subcommittee requests that the description of the Gardner and Pearce awards in the ASTM Directory be amended to include a brief statement of why the award was established and what the individual did that caused the committee to establish an award in his name.

The subcommittee recommends that Gardner and Pearce awardees be notified of their selection, after approval by Sub. D01.90, by the D-1 Secretary who shall establish a mutually agreeable date and place for the presentations. The Secretary shall then notify the D-1 Staff Manager to have the appropriate documents prepared with the approved wording.

W. C. Spangenberg requested additional names of individuals who should be awarded Certificates of Appreciation. With each name a brief statement is needed showing what the individual has done to merit the certificate. D-1 subcommittee chairman are requested to submit the names of their deserving members.

The "point system" for evaluating candidates for D-1 Honorary Membership was reviewed and will be revised to indicate more clearly the basis for awarding the various points.

SUBCOMMITTEE D01.19 GARDNER SWARD HANDBOOK

J. C. Weaver, Chairman

A 14th edition is needed to succeed the 13th edition, STP 500, of the *Paint Testing Manual,* known informally as the Gardner Sward Handbook and affectionately for several decades around the world as the "paint bible."

Every reader is here invited to respond with specific suggestions on general and detailed content and on new authors of the subsections.

The 13th edition is now sold out of the 7500 copies published in 1972 in 600 quarto pages and list priced at $27.50. A 14th edition may be of similar size and necessarily at a higher price. The same general character is favored by most respondees. The 13th edition was the first published by ASTM and differed much from the previous 12 editions issued from about 1920, in closer adherence to advances in testing and relevance to D-1 standards. The Henry A. Gardners, father and son, and G. G, Sward, are forever remembered for their great contributions to this and other facets of the world wide paint community.

Fourteenth edition overall planning and strategy were discussed in depth at January and June meetings of Sub. D01.19. Procedurally, the main and subsections will be replanned to correlate closely with D-1's 29 technical subcommittees. A first solicitation of their chairmen brought seven responses which are definitive enough for editorial management. A followup solicitation is imminent. One of many examples of coordination need is allocation of space for pigments across chemical analysis, appearance, specifications, and artists colors.

Section 8 on specific paint products and 10 on instrumental methods are especially in need of thorough replanning. More academic authors will be sought on instruments.

DIVISION 20 RESEARCH AND GENERAL METHODS

SUBCOMMITTEE D01.20 SAMPLING, STATISTICS, ETC.

H. E. Ashton, Chairman

It was reported that the revision to D 3980 had passed Society ballot without receiving the negative that had been cast when the practice had appeared by mistake on a Society ballot last year. The revised method will be sent to Committee E-11 for comment, asking for advice on the possibility of setting up a computer program based on D 3980. D-1 members will be asked to report any problems encountered in using the practice.

It was suggested that the D 3925 Sampling Practice needs to be extended to include raw materials, such as pigments, resins, and latices. The chairman will review documents on sampling from ISO/TC 35, E-15, D-2, and U.S. Test Method Standard 141.

Sub. D01.20 asked that D-1 subcommittees, when reviewing their standards, incorporate D 3924, "Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer and Related Materials," and D 3925, "Sampling Liquid Paints and Related Pigmented Coatings," where applicable.

SUBCOMMITTEE D01.21 CHEMICAL ANALYSIS OF PAINTS AND PAINT MATERIALS

R. W. Scott, Chairman

D01.21.13, Coordination of VOC Standards and Information, J. C. Weaver, Chairman. Since Sub. D01.21 is trying to correlate D 3960, "Practice for Calculating VOC in Paints," with EPA's Method 24 of October 3, 1980 and 24A of November 8, 1982, the presence of two guests from the U. S. EPA, Emission Control, Research Triangle Park, NC, highlighted the meeting. The Task Group members were able to discuss in detail with these representatives, VOC methodology and its shortcomings.

Round-robin results of Sub. D01.21.56 indicate improvement of precision for the individual methods. However, overall calculations of VOC in water-reducible coatings show variations wider than 100%. The precision obtained on solvent-reducible coatings, on the other hand, are excellent.

Including the concept of VOC use with VNV and transfer efficiency decreases the precision at the paint user's facilities. This subject was discussed thoroughly with Messrs. Crumpler and McAlister. The EPA is well aware of the need to improve the precision of test methods used in determining VOC.

D 3960 will need successive ongoing revisions to incorporate new methods developed by other Sub. D01.21 task groups, such as Sub. D01.21.55's Halohydrocarbons in Paints and those practices for determining nonvolatiles in D 2832 on various classes of coatings and their components. Other exemptable organic solvents besides already exempt halohydrocarbons are under consideration by the EPA.

D01.21.22, Analysis of Electrocoat Bath Samples, A. G. Yeramyan, Acting Chairman, reviewed the results of the Sub. D01.21 letter ballot on the four electrocoat bath sample test methods. Since three negatives were received and extensive editorial revisions were made, these methods will be resubmitted to concurrent Sub. D01.21 and D-1 letter ballot.

As a result of the unacceptable results obtained from the second round-robin on the gas chromatographic analysis of solvents in E/C bath samples, R. Domingo suggested using a UCON LB-550-X, 20%, 6 ft. column for the next round-robin. This column should separate amine. The higher operating temperature of 190°C should eliminate tailing and give better results. A new round-robin will be started as soon as possible.

In the case of analyzing "ionic contamination," it was agreed that cations should be run with atomic absorption spectroscopy. The anionic contaminants will be measured separately instead of trying to find an overall method. The chairman solicits methods to analyze anionic contaminants in E/C bath samples.

D01.21.26, Revision of D 2697, Volume Nonvolatile Matter in Clear or Pigmented Coatings, M. Sites, Chairman, reported that editorial comments and technical points raised by H. E. Ashton were discussed and incorporated, where appropriate. One technical point raised involved the statistical analysis done on the round-robin data in accordance with E 180. There is some question about using the coefficient of variation or standard deviation in calculating precision statements. The data will be submitted to Mr. Ashton for statistical analysis.

Sub. D01.48.04 requested Sub. D01.21 to set up a task group to develop a VNV for inorganic zinc silicate coatings which uses mercury as the "suspending liquid." Although referenced in Note 3 of D 2697, Sub. D01.21 voted not to undertake the request.

D01.21.27, Low Temperature Ash Content of Paints, W. V. Moseley, Jr., Chairman, reported that the method, "Pigment Content of Paint by Low Temperature Furnace Ashing," passed Sub. D01.21 letter ballot with no negative votes. Round-robin results were very good. Coefficient of variation on duplicate runs was 0.11% and precision was 0.31%. Repeatability between days in the same laboratory was 0.10% and precision was 0.28%. Reproducibility between labs was 0.25% and the precision was 0.72%. The method is ready for D-1 ballot.

D01.21.42, AAS Analysis of Pigments, W. V. Moseley, Jr., Chairman, reported that because of a negative vote from Mr. Ashton on a Sub. D01.21 letter ballot on "Determination of Yellow Pigment Content of Yellow Reflective Thermoplastic Striping Material" and the poor precision obtained, the round-robin will be repeated and the method will be resubmitted to Sub. D01.21 ballot at a later date.

D01.21.53, Trace Levels of Monomers in Paint, J. Benga, Chairman, discussed the negatives and comments received on a Sub. D01.21 letter ballot on the method. A negative by Mr. Ashton was resolved. Another round-robin will be initiated prior to the next meeting to generate the needed precision statement.

A method for determining trace monomers in coatings using capillary GC was distributed and discussed. The next round-robin will include evaluation of this method.

D01.21.72, Metals in Air Particulate Samples, L. DiCarlo, Chairman, resolved two negatives and incorporated all comments from a December 1982 Sub. D01.21 letter ballot on the proposed "Standard Method For Lead and Chromium in Air Particulate Filter Samples of Lead Chromate Type Pigment Dust by Atomic Absorption Spectroscopy." The revised draft will be submitted to D-1 letter ballot.

The chairman will head another task group on developing test methods for zinc and phosphorus in zinc hydroxy phosphite pigment. A round-robin is proposed prior to the next meeting.

D01.21.80, Exploratory Analytical Research, K. Leavell, Chairman, reported that as a result of a survey of Sub. D01.21 members two areas will be explored by the task group: (1) Measurement of melamine-formaldehyde resins by Carbon 13 NMR Spectroscopy and; (2) HPLC analysis for residual isocyanate monomers in paints. A proposed method for the former has been written up by A. Yeramyan. This will be referred to Sub. D01.33. The HPLC method will be addressed to Sub. D01.21.53 for method development.

SUBCOMMITTEE D01.22 HEALTH AND SAFETY

H. A. Wray, Chairman

A negative on the Spring ballot of Sub. D01.22 on D 3934 was withdrawn on agreement to change the title to "Determination of Flash/No Flash of Liquids by the Equilibrium Closed-Cup Method."

Several editorial comments were accepted, but a change in the fire hazard caveat was not accepted since it is a part of the Society fire hazard policy.

A number of comments by H. Ashton were accepted on the revision of D3941. Among these was a change in title to "Finite Flash Point of Liquids by the Equilibrium Closed-Cup Method." A change suggested in the wording of the fire hazard caveat was not accepted for the reason given above.

A suggestion by Mr. Ashton that the wording of the titles of all flash point methods be changed to coordinate the

titles will be referred to the ASTM Coordinating Committee on Flash Point.

Comments by Mr. Ashton on D 1310, "Method of Test for Flash Point of Liquids by the Open Cup," to include Fire Point Testing were discussed and will be incorporated where possible.

The purpose of D 4206 and D 4207, the new Sustained Burning Tests, was discussed briefly.

The new test method for determining whether a material is a solid or a liquid for regulatory purposes was discussed. Comments by R. F. Wint indicated a need for an introduction covering the background of the tests. This will be included in the revision of the method. Mr. Ashton's suggestion for a title change was rejected. His suggestion to reference D 3925 on sampling was accepted, as well as deletion of the accuracy statement and to revise the precision statement. However, his suggestion to change the temperature of the test was rejected since the temperature used is that used by the U.S. DOT.

Suggested revisions of this same method by M. Nielsen were reviewed. As the result of the discussion, the method was revised to more accurately determine the flow of the material from a can. A change was also recommended to measure the weight of the free flow of liquid from the can rather than the volume. The method will be submitted to concurrent Sub. D01.22 and D-1 letter ballot.

SUBCOMMITTEE D01.23 PHYSICAL PROPERTIES OF APPLIED PAINT FILMS

M. P. Morse, Chairman

D01.23.10, Adhesion, H. E. Ashton, Chairman, is conducting a round-robin test to determine whether the upper film thickness limit prescribed in method B of D 3359, "Adhesion of Coatings by Tape Test," can be increased so as to make the method more widely applicable. Also, a round-robin is being planned to evaluate a "pull-off" adhesion method. The study will be limited to use of two adhesives. On the basis of some preliminary results obtained with this method, some suggested revisions have been submitted to ISO for consideration.

D01.23.11, Wet Film Adhesion, H. A. Ball, Chairman, reported that a redraft of a practice for measuring wet film thickness of coatings by notch gauges was submitted to Sub. D01.23 letter ballot. Several suggested changes have been incorporated in a new draft that will be submitted to concurrent Sub. D01.23 and D-1 letter ballot. This practice covers the use of two types of notch gauges, namely (1) rectangular or square gauges and, (2) circular gauges.

D01.23.12, Dry Film Thickness, K. A. Trimber, Chairman, has incorporated suggested changes in the proposed revised draft of D 1005 on dry film thickness for submission to Sub. D01.23 letter ballot. This method provides for the use of micrometers in the measurement of free films and of films adhering to substrates. A round-robin has been initiated to determine the precision of micrometer measurement of the thickness of films adhering to substrates.

D01.23.14, Hardness, Abrasion and Mar Resistance, has prepared a new draft of a new method for determining coating hardness with the pendulum damping test, incorporating the suggested editorial changes received from the Sub. D01.23 letter ballot. It will be submitted for D-1 letter ballot. A round-robin is planned to determine the precision and sensitivity of this test. Plans are also being made to investigate the rise of a modified balance beam scratch tester in measuring mar resistance of coatings.

D01.23.15, Slip Resistance, G. D. Ernst, Chairman, discussed a draft of a practice for measuring the static coefficient of friction of coatings. Suggested changes have been incorporated and a revised draft will be submitted to Sub. D01.23 letter ballot. This practice describes the use of two types of measurement, the inclined plane and horizontal pull.

SUBCOMMITTEE D01.24 PHYSICAL PROPERTIES OF LIQUID PAINTS & PAINT MATERIALS

C. K. Schoff, Chairman

Current D01.24 activities of interest include:

(1) The current round-robin to collect data for a precision statement for D 2196, "Viscosity of Non-Newtonian Materials by Brookfield Viscometer."

(2) Completion of revisions of the two oil absorption methods, D 281 (spatula rubout) and D 1483 (Gardner-Coleman method) which will be submitted for concurrent Sub. D01.24 and D-1 letter ballot.

(3) Passing of concurrent ballots by the proposed Method for High Shear Viscosity by ICI Cone/Plate Viscometer, which will be submitted for Society ballot after a number of editorial changes have been made.

(4) A controversy which has developed concerning the lack of standardization of Zahn cups and the fact that the calibration equations in D 4212, "Viscosity by Dip-Type Cups," do not fit Zahn cups made by one manufacturer. More discussion on this problem will occur at the December meeting.

New projects include writing of methods for A.C. volume resistivity of liquid coatings (Task Group on Electrical Properties of Liquid Coatings) and for low shear viscosity by the relaxation method (Task Group on Viscosity by Rotational Viscometers).

SUBCOMMITTEE D01.26 OPTICAL PROPERTIES

C. J. Sherman, Chairman

D01.26.02, Color Measurement, C. S. McCamy, Chairman, reported that D 3134, "Selecting and Defining Color and Gloss Tolerances of Opaque Surfaces and Evaluating Conformance," will be revised and balloted by the subcommittee.

D 1535, "Specification of Color by the Munsell System," was revised to include a significance and use statement, and will be simultaneously balloted by main and subcommittee.

D 2244, "Instrumental Evaluation of Color Difference of Opaque Materials," will be extensively revised and simplified and submitted for balloting by the subcommittee.

A draft of a proposed standard practice of defining, selecting, and maintaining color standards will be submitted for balloting by the subcommittee.

D01.26.06, Hiding Power, L. Schaeffer, Chairman, reported that D 344, "Relative Hiding Power of Paints by Visual Evaluation of Brushouts," received technical and editorial comments in the latest subcommittee balloting. A revised draft incorporating these comments will be ballotted by the main committee provided any negatives received by the closing date of this ballot (July 25) can be resolved.

D01.26.11, Gloss and Goniophotometry, R. L. Hunter, Chairman, reported that the proposed Method for Visual Evaluation of Gloss of Similar Appearance is ready for Society ballot.

The revision of D 523 in subcommittee balloting received comments that will be incorporated and submitted for reballoting by the subcommittee.

D01.26.23, Retroreflectance of Horizontal Coatings, N. L. Johnson, Chairman, reported that the title of D 4061, "Specific Luminance of Horizontal Coatings," will be changed to "Retroreflectance of Horizontal Coatings." Also, the method will be revised and a round-robin conducted to determine the improvement in the precision by this change.

SUBCOMMITTEE D01.27 ACCELERATED TESTS FOR PROTECTIVE COATINGS

E. A. Praschan, Chairman

Two standards (D-1654, "Painted or Coated Specimens Subjected to Corrosive Environments," and D-2454, "Determining the Effect of Overbaking on Organic Coatings") have been reviewed. Except for the addition of a "Significance and Use" section in D-2454 these methods will be balloted at Committee and Subcommittee levels as they now appear in the Book of Standards.

D01.27.02, Water Tests, G. Grossman, Chairman, reported that a round robin to compare the four water test methods (D-714, D-870, D-1735, and D-2247) is underway with panels artificially contaminated with varying concentrations of salt prior to painting. Based on results obtained to date, the round-robin will be expanded to include panels which should enable us to better define the size and amount of blistering that occurs.

D01.27.04, Light and Water Exposure Apparatus, S. Totty, Chairman, reported that a new standard practice for the use of fluorescent UV/condensation apparatus (G-53) for paint and related coatings was on subcommittee ballot during the past period. A number of negatives and several comments were received requiring the rewriting of the proposed practice. The new draft was discussed at the meeting. After the draft is modified, based on comments made during the meeting, it will be submitted for editorial review and then resubmitted for subcommittee ballot.

D01.27.09, Corrosion Tests, B. Williamson, Chairman, heard a report on the status of various cycle tests to produce "scab" corrosion given by the chairman. It is expected that the study will be completed by the December meeting at which time the group can initiate the writing of a standard for a cyclic test for evaluating this form of corrosion.

D01.27.10, Accelerated Outdoor Weathering, M. Morse, Chairman, reviewed results obtained using the new EMMA-NTW cycle at DSET Laboratories. To date it appears that this type of exposure has good correlation with 5° open rack exposure in Florida. Tests are continuing in order to determine the acceleration factor possible with the EMMA-NTW cycle.

D01.27.11, Revision of D-2485, J. Robbins, Chairman, reported that a redrafting of D-2485, "Coatings Designed to be Resistant to Elevated Temperatures During Their Service Life," has been completed. The new draft will be placed on D-1 ballot prior to the December meeting.

D01.27.16, Chalking, J. Robbins, Chairman, discussed errors made in the printing of D-4214 -83, new standard practice for chalking. Copies of the corrected practice will be available soon and the errors will be corrected in the 1984 edition of the *Annual Book of ASTM Standards.*

D01.27.17, Evaluation of Weathering Effects, A. Allen, Chairman, has been activated to revise D-660, "Evaluating Degree of Checking," and D-661, "Evaluating Degree of Chalking," to update these methods. The chairman will draft a revision for discussion during the December meeting.

SUBCOMMITTEE D01.28 BIODETERIORATION

D. L. Campbell, Chairman

D01.28.01, Package Stability, W. B. Woods, Chairman, reported that the tentative Preventive Challenge Test Method for evaluating the capacity of preservatives to prevent microbial spoilage of paint will be run by four laboratories in a round-robin test. This study should be completed before the December 1983 meeting. Correspondence will be directed to W.R. Springle, of PRA (England), as his recent paper citing ASTM Method D 2574-80 is relative to this task group's current work.

D01.28.02, Rapid Determination of Enzyme Presence, A. J. Desmarais, Chairman, found the results of the tests run with the ATP Photometer were inconclusive. Consequently, a method using a low substitution carboxymethylcellulose will be evaluated by participating laboratories in a round-robin test. The results should be available at the December meeting.

D01.28.03, Accelerated Tests, K. A. Haagenson, Chairman, has currently been deactivated. Inconsistent and noncorrelatable results of exterior exposures at various sites make it impractical to consider the present proposed method for predicting the long term performances of fungicides further. The task group will be reactivated when a new method is devised.

D01.28.04, Resistance of Paint to Algae Attack, W. B. Woods, Chairman, reported that fresh cultures of the algae "oscillatoria" will be supplied to three participants in a round-robin study to determine if algae can consistently be grown on unprotected paint films. This study should be completed by December 1983.

D01.28.05, Recoating Mildewed Surfaces, D. L. Campbell, Chairman, reported that a corrected draft of the "New Standard Guide for Determining the Presence of and Removing Microbial (fungal or algal) Growth on Paint and Related Coatings" will be prepared and submitted to concurrent Sub. D01.28 and D-1 letter ballot. The following statement will be added, "This guide should preferably be used by persons who have had basic microbiological training."

SUBCOMMITTEE D01.29 SUBSTRATE PREPARATION FOR COATING TESTING

S. D. Ozenich, Chairman

The proposed round-robin to determine the effects of certain variables on the uniformity of results obtained on sandblasted panels was discussed.

Sub. D01.29.01 worked out most of the remaining details of the proposed testing. The group agreed on the following:

(1) Only one profile would be tested and it should be 1.0–1.5 mil.

(2) Panels prepared for testing after storage would be wrapped immediately after blasting in VCI impregnated paper and sealed in plastic bags. G. Grossman offered to supply the necessary materials.

(3) After discussion with H. Ashton, it was decided that at least four cooperators would be needed for the test.

(4) The group decided that three coating systems should be used—alkyd, epoxy, and inorganic zinc.

It was agreed that while it would be more beneficial to have only one cooperator coat all the panels blasted by all the cooperators, this would only be possible on the series slated for long term storage. It was agreed that panels would have to be coated at 1, 6, and 24 hours after blasting by each of the labs to determine if deactivation of the metal produces significant performance differences.

The chairman will contact R. Allen, of DuPont, to find out if any ISO standards exist on the preparation of sandblasted panels for testing.

DIVISION 30 PAINT MATERIALS

SUBCOMMITTEE D01.31 PIGMENT SPECIFICATIONS

C. W. Fuller, Chairman

The subcommittee resolved the following matters:

(1) D 480, D 964, D 3619, and D 603 will be reballotted with proper changes in form.

(2) A hazard statement similar to the one on D 1649 should be added to chromate-containing pigment specs like D 83, D 211, and D 2218. These then should be submitted to concurrent Sub. D01.31 and D-1 ballot.

(3) D 476 on Titanium Dioxide was revised and will be submitted to concurrent balloting.

(4) The comments on D 520, Zinc Dust, by Ashton, DeWilde, and Smith were reviewed, found applicable and added for reballot.

(5) The calcium boro-silicate specification was reviewed and editorially corrected for Society balloting.

(6) A task group is being formed to work with E-34 (OSHA) on water-insoluble chromates; the task group will be represented at the E-34 meeting October 17–19 in Bal Harbour, FL.

(7) The reference standard for dry brightness of clay and other extender pigments, D 602, D 603, and D 605, should be changed from freshly fumed MgO to a permanent standard. This change will be discussed with Sub. D01.26.

(8) A proposed standard specification for zinc hydroxy phosphite pigment was presented by P. Mitton. Comments by the committee and this proposal will be rewritten for submission to Sub. D01.31 for D-1 ballot.

(9) Notification was given of a decree by the Navy through Helen Moore, of Naval Facilities Engineering Command. They will not use the various paints by SSPC, containing chromates, coal tar (solvents and resins), lead, and asbestos. She asked for Sub.D01.31 comments. It was suggested that E-34 and SSPC be contacted.

SUBCOMMITTEE D01.32 DRYING OILS

P. C. Stievater, Chairman

Since Sub. D01.32 has about 30 methods due for reapproval in 1984, a request will be made to list about 15 methods on each of the next two D-1 ballots. On the next round of reapprovals, consideration will be given to early reapproval of some methods to even out the schedule to about 12 methods per year. At present, only two or three methods are due for reapproval in some years, with as many as 16 and 30 due in other years. Since Sub. D01.32 has about 60 methods under its jurisdiction, about 12 reapprovals per year would even out the workload.

Results of a questionnaire sent out to all Sub. D01.32 members, as well as to the analytical departments of a number of other producers of oil and fatty acid type products, regarding the usage of test methods and specifications under our jurisdiction, have been tabulated. Although the returns so far have been light, they suggest considerable usage of these methods, as well as some other in-house methods. One respondent suggested the development of two new methods based on their own methods. An effort will be made to obtain additional returns of questionnaires prior to summarizing the results.

SUBCOMMITTEE D01.33 VARNISH & RESINS, INCLUDING SHELLAC

A. C. Abbott, Chairman

The subcommittee chairman will propose at the December meeting to combine the task groups on Varnishes (D01.33.01) and Alkyds (D01.33.14). Members should also be prepared to discuss expanding the task group on Polymer Emulsions (D01.33.26) to cover all water-borne and water-reducible vehicles.

D01.33.01, Varnishes, H. A. Ball, Chairman. A. C. Abbott acted as chairman in the absence of Chairman Ball. All negatives and comments from the main committee and subcommittee concurrent ballot of D 1639, "Acid Value of Organic Coating Materials," D 1647, "Standard Test Method for Resistance of Dried Films of Varnishes to Water and Alkali," and D 1643, "Test Method for Gas Checking and Draft Test of Varnish Films," were resolved or incorporated as appropriate. A revised D 1643, prepared by H. Ball, will be ballotted concurrently by Sub. D01.33 and D-1. J. C. Weaver will work with the appropriate government agencies to get D 1643 references eliminated, so that when it is reviewed in five years objections to its being withdrawn will have been met.

D01.33.23, Epoxy and Phenolic Resins, H. D. Marshall, Chairman, adopted comments from the concurrent ballot of the New Standard Test Method for Total Chlorine in Epoxy Resins and Compounds. A comment from P. Mur-

ray was technical. The method will be reballoted.

D01.33.24, Nitrogen Resins, J. Smith, Chairperson, reported that the editorial comments from the concurrent ballot of the New Standard Practice for Testing Amino Resins were incorporated, as appropriate, and the practice will proceed to Society ballot. A proposed method for determining the formaldehyde content of amino resins will be circulated to potential cooperators in a round-robin for comment. Ken Leavell, of Sub. D01.21.80, proposed a method for analysis of amino resins by C-13 NMR. Cooperators are being sought for a round-robin.

D01.33.25, Polyvinyl Chloride and Polyvinyl Butyral, A. C. Abbott, Acting Chairman, reported that all editorial comments from the subcommittee ballot of the proposed New Standard Guide for Testing Poly(Vinyl Chloride) were incorporated. The method will be ballotted by D-1.

D01.33.26, Polymer Emulsions, O. E. Brown, Chairman, reviewed a second draft of a proposed Test Method for Filter-Retained Solids Content of Latex Vehicles. A round-robin will test two latexes each designed for caulks, flat coatings, and semi-gloss coatings, respectively, with appropriate screen sizes. The group chairman will survey major producers of water-based or water-reducible vehicles to identify needs for test methods of those used in coatings and inks.

SUBCOMMITTEE D01.35 SOLVENTS, PLASTICIZERS AND CHEMICAL INTERMEDIATES

L. R. Thurman, Chairman

D01.35.01, Hydrocarbon Solvents, S. A. Yuhas, Jr., Chairman, reviewed suitable replacements for D 891. D 1298, "Test for Density, Relative Density (Specific Gravity), or API's Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer" was chosen as the best alternative, since D 1298 has been adopted by API, IP, ANSI, DIN, British Standards, and the Dept. of Defense.

D01.35.02, Oxygenated Solvents, T. H. Golson, Chairman, in response to a letter survey on test methods for water in urethane solvents, agreed that the precision in D 1364 would probably be acceptable to users and producers of these materials. When preparing specifications for low (less than 0.05% wt) water in urethane solvents, reference to D 1364 will be made and a general statement will be included as to the careful handling of such products.

J. DeWilde, on a previous ballot, had requested the substitution of ISO-5277 for D 1353 (Non-volatile Matter in Volatile Solvents). The two methods were compared by the task group. It was felt that the inherent problems with the steam bath (D 1353) are similar to the nitrogen stream (ISO-5277). It was decided that an editorial comment should be added to D 1353 as follows, "Caution: The evaporation should be conducted slowly. Do not allow the specimen to boil vigorously or to spatter."

Mr. DeWilde, H. Fujimoto, and R. W. Scott questioned the necessity of describing the making of Karl Fisher reagent in D 1364 since most labs buy commercially prepared material. Consensus was that purchased material would only be acceptable if the supplier guarantees precision equal to or better than that stated in D 1364.

D01.35.03, Chemical Intermediates, J. R. Morrison, Chairman, reviewed a proposed specification for glacial acrylic acid and a test method for dimer in acrylic acid. Both will be submitted to Sub. D01.35 ballot.

In review of a proposed specification for 2-ethyl hexanol, a suitable gas chromatographic method is needed to determine ethyl methyl pentanol content and purity. Discussion of G.C. methods will be an item for the next meeting.

In the subcommittee meeting, it was reported that the safety caveat has been formalized and published in proper style in the "blue book." D 1298 has been determined to be a suitable substitute for D 891 (specific gravity). Glacial acrylic acid and dimer have been finalized and will be balloted.

PPP-C-2020 was proposed and balloted as part of a packaging and marking statement in several specifications. They received negatives which were found not persuasive because the reference to the federal standard is not mandatory in the event of procurement and is a compromise on inclusion. It was further resolved that the chairman would request Sub. D01.90 to develop an ASTM standard packaging and marking specification which would incorporate the major points in PPP-C-2020.

In conjunction with the development of a gas chromatographic method for 2-ethylhexanol, etc., application to the analysis of other alcohols will also be considered.

DIVISION 40
PAINT PRODUCTS APPLIED ON SITE

SUBCOMMITTEE D01.41 CRITERIA FOR THE PURCHASE OF COMMERCIAL PAINTS AND COATINGS

R. A. Brown, Chairman

The chairman stated that the objective of the subcommittee is to develop a method for purchasing commercial paints and coatings which will be satisfactory to Federal, State, and other government agencies, plus other institutions, and which will also be satisfactory to paint producers, distributors, and others who sell commercial paints.

The chairman said that although the present objective of Sub. D01.41 had been narrowed to finding a method for purchasing interior latex flat paints, the subcommittee has not yet developed a satisfactory method. He again asked anyone interested in this problem to submit suggestions for such a method. He described briefly the present "Standard Guide for State and Institutional Purchasing of Paint," D 3927, developed by Sub. D01.41 in 1980. D 3927 presents three methods for purchasing architectural paint products: (1) Active Ingredients/Cost Ratio Method; (2) Performance/Cost Ratio Method; and (3) Specification Method. Several states presently make use of D 3927 in their purchasing activities. The chairman recommended that if a revision of D 3927 is made to satisfy the needs of the Federal Government's purchasing of paints, it be given a new number and D 3927 be kept active for those who wish to use it.

W. V. Moseley, Jr., Chairman of Sub. D01.41.01 reported that GSA officials in Washington, D.C. have recommended that a trial procurement of interior flat latex paint be made by GSA Region 10, which is located in Seattle, WA. This procurement may be made in 1983 or 1984. Moseley has offered the services of the State of Virginia in helping GSA purchase paint by the Active Ingredients/Cost ratio method used by Virginia.

Following considerable discussion on the problems faced by purchasing agents in government agencies who must buy paint products, a motion was made to form another working group in which purchasing people are invited to participate and spell out their requirements. Once this group has outlined a potential method for purchasing commercial paints, it will be presented to Sub. D01.41 for discussion and approval. The motion passed. Moseley will get this working group organized and arrange for a meeting.

It was evident from the discussions that there is a growing need for a paint purchasing method that will help purchasing agents in government agencies and other institutions. Purchasing people with no technical knowledge are being required to buy good quality paint products, and their actions must be legally defensible.

SUBCOMMITTEE D01.42 ARCHITECTURAL PAINTS

R. H. Rowland, Chairman

D01.42.04, Wet Adhesion, F. Winkelman, Chairman, reported that the procedure for the upcoming round-robin has been drafted and will be sent to the nine cooperators within the next few weeks. Several modifications were suggested for the procedure. These suggestions will be incorporated into the procedure. Two different methods for evaluating wet adhesion are included in the draft, a knife peel test and a cross-cut tape test.

D01.42.06, Standard Practice for Testing Latex Semi-Gloss and Gloss Paints, S. LeSota, Chairman, revised the second draft of Recommended Practices for Testing Interior Latex Semi-Gloss and Gloss Paints. Minor editorial changes were made at the meeting and the draft will be submitted to H. Ashton for editorial critique and eventual Sub. D01.42 balloting.

D01.42.09, Color Compatibility, R. H. Rowland, Chairman, reviewed editorial revision #9. Several changes will be made. The specification of a standard brush and changes or variations in the amounts of colorants added were addressed. Cooperator panels and Delta E CIELAB readings were presented. It was suggested that a new round-robin be conducted utilizing colorants and coatings which will provide a wider variation in Delta E results than was encountered during the first round-robin.

D01.42.13, Brushability, J. Desmarais, Chairman, reviewed data presented on results of high shear viscosity measurements compared to hand brushouts on 13 commercial latex paints. Hand brushouts of the various paints were made with two different types of brushes over two different substrates. Correlation between instrumental and hand brushout methods was relatively good with all four combinations of brushes and substrates. Six paints were selected from the 13 tested. These will be used by the six cooperators.

D01.42.16, Opacity (Practical Method), R. Armstrong, Chairman, reported that three latex paints of different hiding were evaluated in a round-robin by roller application over a paper substrate which had been coated with three gray stripes of different light reflectance. Paints were applied at 400 sq ft/gal in one and two coats. Cooperators were asked to visually and instrumentally evaluate the paints after they had dried. Ranking of the test paints for hiding was good, cooperator to cooperator, even though instrumental readings between cooperators were not good. The chairman will conduct tests using a 3″ roller with shorter nap and a smaller test panel prior to the next meeting.

D01.42.17, Roller Spatter, J. Price, Chairman, explained that the planned round-robin had not yet commenced since new formulations of the trade paints used in the test were greatly reduced in spatter generation. Results obtained by use of both the notched spool technique and a "low spatter" roller cover were shown to the group. Although the notched spool technique generated less spatter, excellent correlation existed between the two methods. Modifications will be made to the notched spool to generate more spatter. Following testing by the chairman, a new round-robin, using the notched spool, will be conducted.

SUBCOMMITTEE D01.44 TRAFFIC COATINGS

R. L. Davidson, Chairman

D01.44.01, Thermoplastics, J. O'Brien, Chairman, has organized a round-robin for bond strength, abrasion resistance, effect of freeze-thaw, and directional reflectance.

D01.44.02, Traffic Paint, (No chairman), is preparing D 711, "Determination of No Track Time for Traffic Paint," for Society ballot and D 2205, "Recommended Practices for Traffic Paint," for concurrent Sub. D01.44 and D-1 ballot.

D01.44.02A, Chlorinated Rubber Traffic Paints, C. M. Winchester, Chairman, has organized an investigational team to evaluate a new test method to determine chlorinated rubber content in traffic paints by infrared spectroscopy.

D01.44.03, Night Visibility, J. Ritter, Chairman, discussed recent round-robins of sieve analysis and roundness of glass beads. Suggestions were made to better describe the test procedures in an attempt to improve the precision of the two test methods.

D01.44.06, Bead Retention, E. Kelch, Chairman, tabled a recently evaluated method for the present time. Other

avenues will be investigated in an attempt to find an appropriate method.

C. M. Winchester gave an interesting slide presentation on his study on the relationship of durability, appearance, and retro-reflectance to the overall effectiveness of a traffic line. The study was done at seven different sites around the country. This work will be of great value to all those interested in evaluating traffic line wear, and also the use of retro-reflectometers.

SUBCOMMITTEE D01.45 MARINE COATINGS

L. S. Birnbaum, Chairman

D01.45.05, Algae Control, D. C. Stevens, Chairman. In the absence of the group chairman, L. S. Birnbaum presided. He said he will obtain the proposed rating system for mailing to subcommittee members with a request that comments be forwarded directly to Chairman Stevens.

D01.45.06, Dynamic Testing, D. Laster, Chairman, reported that the U. S. Navy needs a standard test for evaluating antifouling performance and wear of underwater hull coating systems for use in a performance specification. Chairman Laster and the attendees reviewed a draft of a proposed method, paragraph by paragraph. Appropriate revisions were made. This will form the basis of Draft #1 to be circulated to the members for comment prior to the December Meeting.

D01.45.07, Antifouling Rating, C. Perez, Chairman, reported that the round-robin results from the Pearl Harbor exposure site showed surface oxidation of the copper oxide antifouling coating. This phenomenon did not appear on either the Battelle or Miami Marine Research and Testing Station exposures.

An anomaly appeared on both sets of exposure panels by Miami Marine. At the end of eight months exposure, both sets showed significant fouling. A couple of months later, the fouling had diminished on the static exposure set and disappeared on the dynamic set.

In the Sub. D01.45 meeting, Chairman Birnbaum reported increasing interest in government use of ASTM standards for procurement of paints (products as well as methods of testing). ASTM F-25.02 has organized a group to investigate conversion of Military Specifications to ASTM standards. Two coatings manufacturers agreed with a need for such standards and were in favor of performance standards modeled after SSPC maintenance standards. Chairman Birnbaum will check concerning F-25.02 vs D-1 responsibility in this area.

A motion was passed to ballot Sub. D01.45 to determine areas and priorities of interest from the following seven proposed projects for activation: (1) Surface Profile (roughness); (2) Underwater hull cleaning; (3) Ablation rates of underwater hull systems; (4) Release rates of bioactive materials from antifouling coatings; (5) Inspection of ship for performance of underwater hull systems; (6) Blister resistance of marine paint systems; and (7) Performance specs for marine coatings.

D-1 members have been invited by C. Perez to tour his exposure site during the December 1983 meeting. Interest by Sub. D01.45 members to inspect round-robin panels will be determined by a questionnaire.

SUBCOMMITTEE D01.46 INDUSTRIAL PROTECTIVE PAINTING

D. M. Berger, Chairman

D01.46.02, Surface Preparation, K. Trimber, Acting Chairman, reviewed Draft 3 of "Standard Practice for Field Measurement of Surface Profile of Blast Cleaned Steel." The practice covers the use of comparators, depth micrometers, and replica tape for the measurement of surface profile of blast-cleaned metal substrates. Draft 4 will be prepared and submitted to ballot.

The need for a standard for determining abrasive cleanliness (chlorides, sulfates, grease, etc.) was discussed. R. Wakefield will collect data on the subject for a future draft.

D01.46.04, Pull-Off Adhesion, A. Cunningham, Chairman, reviewed Draft 4 of "Method for Portable Pull-Off Adhesion for Coatings." All comments will be incorporated into a new draft for concurrent Sub. D01.46 and D-1 ballot. Chairman Cunningham reported that round-robin tests are well underway with four laboratories having prepared panels and four laboratories running the tests. Preliminary results indicate that substrate thickness (1/8″ vs 1/4″) affects results. There is no difference between scoring and not scoring around the dolly. The mode of failure between laboratories was similar. Another series of test panels is going to be included in the round-robin, as well as a collar (large washer) that fits over the dolly and may provide sufficient rigidity to improve the adhesion values on thin panels.

D01.46.07, Inspection, K. Trimber, Acting Chairman, reported that the latest revision of D 1014, "Standard Method of Conducting Exterior Exposure Tests of Paints and Coatings," received one negative vote (H. E. Ashton) in the 83-2 letter ballot. The negative was found persuasive. All comments were found to be editorial and the negative was withdrawn subject to these changes. A revised copy will be submitted to Society ballot.

Draft 3 of D 3276, "Standard Guide for Painting Inspectors," was circulated along with report forms. It was felt that much of the educational material in the guide should be removed and attached as an appendix. It was agreed that the guide itself should be an orderly procedure on how to inspect surface preparation, coating application, etc., without being bogged down with the mechanics of how surfaces are prepared, coatings applied, etc. Two guides will be prepared, complete with a "punch list" report form, "Standard Guide for the Inspection of Architectural Coating Work."

SUBCOMMITTEE D01.48 ZINC RICH COATINGS

D. C. Kinder, Chairman

D01.48.02, Determination of Cure, J. Lanning, Chairman, is considering Coin Rub—Pencil Hardness Correlation. Stone and Webster has submitted their procedure for coin rub. The Oechsle gauge for scratch or scrape hardness was demonstrated. The chairman will study the gauge further. D-33 has a round-robin in progress for determination of cure with this gauge. A similar evaluation will be designed for Sub. D01.48.

D01.48.03, Lab Tests, R. Wakefield, Chairman, reported a second draft in progress. A round-robin will be designed for test results prior to subcommittee ballot.

D01.48.04, Film Integrity and Solids by Volume, D. C. Kinder, Chairman, discussed NACE modification of D 2697 for use with inorganic zinc coatings. The NACE procedure was also discussed at the Sub. D01.21 meeting. The latest NACE procedure will be revised into ASTM format for submittal to Sub. D01.21.

Sub. D01.48 chairman, D. C. Kinder, submitted copies of recent NACE work for review by Sub. D01.48. R. S. Shane volunteered to review NACE 6B173, "Organic and Inorganic Zinc-Filled Coatings for Atmospheric Services," to put into ASTM format as a guide. He will also write for confirmation of NACE's permission to circulate copies and to report the study of 6B173.

G. McLeod volunteered to review SSPC Guide 12.00, "Selecting Zinc Rich Painting Systems," with respect to ASTM format.

Taylor Engineering responded with information on a new adhesion tester. D. Ballard, of Micro Source, and R. Fisher,

of F.I.N.S. Co. demonstrated the System 2000 to the group. It is an electronically controlled pneumatic tester using studs adhered to a coating surface. A. Cunningham will send to Mr. Ballard a set of the steel panels recently used in the Sub. D01.46 Elcometer round-robin to be evaluated on the System 2000. The data will be reported at the next meeting.

DIVISION 50 PAINTS FOR FACTORY APPLICATION

SUBCOMMITTEE D01.51 POWDER COATINGS

C. Grenko, Chairman

D01.51.01, Editorial and Definitions. T. Toplisch will review the definitions contained in D 3451, make changes and updates where necessary, and submit them to the subcommittee.

D01.51.02, Physical Properties of Powder Coating Materials. E. Marx led a discussion on items requiring action by the group. A compiled list was prioritized with four tests chosen as candidates for work. Tests for specific gravity, particle size distribution, moisture content, and volatile content are going to be written. The chairman requested any existing test methods used by members in these areas to be submitted to him for consideration.

D01.51.03, Applications and Film Formation, R. Huddleston, Chairman, discussed subdividing this group because of the work load. In the applications area, a recommended practice for compatibility of powders will be reworked and submitted to the subcommittee. A draft of a recommended practice for a first pass transfer efficiency will be completed by the next meeting. Consideration of an impact fusion test resolved that at this time a need is realized, however, there is no known method for standardization. A Pill Flow standard test method is being drafted. A reference of applicable ASTM documents for melt rheology of powders will be prepared for discussion by the next meeting.

D01.51.04, Properties of Powder Coating Films, C. Danick, Chairman, requested that any test methods currently in use on cure end point, hiding power, or edge coverage be submitted to him. Plans are to draft procedures on these tests as soon as possible.

D01.51.05, Safety and Hazards, K. Kipp, Chairman, discussed LEL and waste disposal. It was concluded that these items should be referred to other groups having expertise in these areas and, at this time, standardization of a procedure by ASTM is not practical.

SUBCOMMITTEE D01.52 FACTORY-COATED WOOD PRODUCTS

R. C. Marck, Chairman

D01.52"B", Hardboard, S. B. Schroeder, Chairman, heard a recapitulation of the recently identified problem of swelling in hardboard siding caused by surfactants in some trade sales house paints. Data was presented showing possible correlation between test fence exposures and various rapid wetting tests. This information will be distributed to potential volunteers for a round-robin to be organized at the next D-1 meeting.

D01.52.12, Textured Wood Products, R. C. Marck, Chairman, discussed test data exploring the durability of low density areas on textured, prefinished hardboard siding to weathering. These tests indicate that the low density areas have become so impregnated with paint that they weather approximately equal to the higher density areas. Discussion led to the question of whether the durability of a textured, prefinished siding was superior or inferior to a comparable flat panel. This question will be investigated and the results discussed at next summer's meeting.

D01.52/55, Formaldehyde Emissions, R. C. Marck, Chairman, reviewed various test methods for preparing samples and for testing formaldehyde content. It was agreed that formaldehyde emissions from wood products should logically fall within the scope of Committee D-7. However, a meeting will be held in six to 12 months to keep abreast of work being done by various other testing organizations in this area.

SUBCOMMITTEE D01.53 COIL COATED METAL

R. A. Cassel, Chairman

A letter of recruitment was sent to 41 coil-related companies which currently do not have active participation in Sub. D01.53. A positive response has been received from one company solicited.

D01.53.01, Formability, W. H. Gunn, Chairman, reported that D 4146 will have to be reballoted as one of the editorial items was resolved by deleting a paragraph from the document. All affirmative comments were resolved.

D01.53.02, Cure, R. A. Cassel, Chairman protem, reported a new round-robin for the Finger-Rub method is in the planning stage. The previous round-robin gave spurious data due to co-operators not following the enclosed directions.

The document for the method of determining phosphate coating weights on zinc surfaces is ready for concurrent ballot of Sub. D01.53 and D-1. The group discussed a forth-coming round-robin on iron and zinc phosphate on steel surface coating weight determinations. A chromate on aluminum study being performed by the National Coil Coater's Association was also discussed.

D01.53.04, Test Methods, R. A. Cassel, Chairman protem, reported that significance and use statements have been developed for D 3003, D 3281, and D 3794, which hopefully will be ready for the Fall ballot. There was also a discussion on the need for a document covering the "Nickle Scratch Test" that is commonly used in the coatings industry. A letter will be sent to various industry groups that use the method to determine the interest in the development of such a standard.

SUBCOMMITTEE D01.55 FACTORY-APPLIED COATINGS ON PREFORMED PRODUCTS

F. Zurlo, Chairman

D 3133 and D 2353 were approved unanimously on a concurrent Sub. D01.55 and D-1 ballot. Two members suggested the addition of a standard safety clause. This was added to both methods. Additionally, H. E. Ashton submitted 2½ pages of editorial comments. All, except one, were accepted. The methods are ready for Society vote.

D 365, D 2198, D 2337, and D 2378 were reviewed and approved for concurrent Sub. D01.55 and D-1 ballot. Significance and use statements were added to two: precision statements to two, and a precaution (Safety) statement to one. These methods are now ready for concurrent Sub. D01.55 and D-1 ballot.

D 1211 and D 3170 need review this year. M. Mull will add specification requirements for test panels to D 1211. Significance and use statements will also be added. The proposed changes on D 1211 may result in a round-robin.

SUBCOMMITTEE D01.56 PRINTING INK

J. M. Fetsko, Chairman

D01.56.02, Lightfastness, J. Benson, Chairman, heard a report that six laboratories completed part of a round-robin in which 12 different lithol rubine prints were exposed along with NBS standard

paper in carbon arc fadeometers for three 24-hour cycles. The prints are to be evaluated by three-filter densiometry and by various color difference parameters. After a suitable method of numerical evaluation is agreed upon, the round-robin will continue with yellow, red, and blue prints prepared by a single source. It will include carbon arc and xenon lamps.

D01.56.06, Ink Tack, C. Shepard, Chairman, distributed a precision statement developed from a round-robin in which six to eight laboratories ran 10 tests on each of six inks on either the regular or the electronic Inkometer. The new precision statement overcomes two negatives to the Sub. D01.56 ballot of the new standard, "Apparent Tack of Printing Inks by the Inkometer." The method can now be submitted to D-1 ballot.

D01.56.09, Tinting Strength, W. Reidel, Chairman, discussed requirements and plans for a round-robin on tinting strength. In order to separate effects of the dispersion method from the let-down method, three flushes will be distributed along with zinc oxide and titanium dioxide bases. Strength evaluations will be made gravimetrically at 1:50 letdowns. An optional part will be instrumental determinations, which may require adjustments to the tint level.

D01.56.10, Water Uptake, G. Bien, Chairman, distributed a brief report which concluded, on the basis of two round-robins, that water uptake measurements by themselves did not predict lithographic printing performance. A more detailed research report is to be prepared.

D01.56.11, Non-Volatile Matter in Heat-Set Inks, B. Blom, Chairman, reported that a round-robin will be conducted in which six heat-set inks consisting of single and mixed oils will be tested at two film thicknesses and oven times. The preferred test conditions will be selected on the basis of best precision and accuracy.

D01.56.12, Fineness of Grind, J. Cichon, Chairman, reported on the preparation of the required precision statement for D 1316, "Fineness of Grind of Printing Inks by the Production Grindometer." Results of a round-robin suggest that the report section of the method be modified to require that scratch readings from form paths (two drawdowns on a double path gauge) be averaged. Apart from the current method, a new round-robin will be conducted to compare the precision and differentiating ability of scratch vs. gloss readings on Grindometer drawdowns.

D01.56.13, Ink Mileage, B. Blom, Chairman, reported that two sets of process inks varying in mileage on a production press are now in hand. In lieu of production prints, the inks will be distributed along with laboratory prints as standards for color density.

SUBCOMMITTEE D01.57 ARTISTS' PAINTS AND RELATED MATERIALS

J. T. Luke, Chairman

D01.57.01, Preparation of Samples for Colorimetric Determination, H. W. Levison, Chairman. The proposed method has been written and is still being held because some of the colorimeteric measurements were made at incomplete hiding. Because incomplete hiding was obtained at 6 mil thickness from transparent and semi-transparent artists' paints, it has become extremely difficult to obtain a high degree of precision for this test method.

At present, there is not an ASTM test method for preparing draw-downs of paste paints, and one is needed for other related standards for artists' paints. The Subcommittee Chairwoman then asked that Task Group members rewrite the proposed method into a practice and make a precision statement that can be achieved using this method.

H. Levison will prepare this information. Working time will be scheduled at the next ASTM meeting in December to go over this practice.

D01.57.02, Lightfastness of Pigments, H. W. Levison, Chairman. Draft 4 of the "Standard Test Methods for the Determination of the Relative Lightfastness of Pigments Used in Artists' Paints" has been balloted at the Subcommittee and Committee levels. Several negatives have been received on this proposed standard and were reviewed at the Planning Committee Meeting, along with the editorial changes. The review of Draft 4 was not completed at the Planning Committee Meeting so the remainder of the time allocated for this Task Group was spent on the review.

D01.57.03, Tinting Strength of Pigments, T. Pamer and I. Shack, Co-chairmen. T. Pamer and E. Stephens, working with M. Johnson, presented data on tinting strength tests done using the method proposed by Ruth Johnston-Feller. Cadmium red medium and cadmium yellow medium acrylic colors were chosen for this work. Various competitive samples were obtained. One competitive sample of red and yellow was selected for a standard and tints of these standards were made at various known concentrations. Draw-downs were made and colorimetric measurements taken. A plot was then made of K/S vs. pigment concentration.

The remaining competitive samples were then tinted with the same white. Corrected and uncorrected relative tinting strength calculations were made comparing the various competitive samples with the standard.

Data revealed a good correlation between relative tinting strength rankings and visual rankings as long as the colors were close to the standard. As the colors get further from the standard, the relative tinting strength data gets less accurate.

Additional work will be done to see if this method can be used to set a lower level of tinting strength for various categories. Paints that would not reach the low level would be too weak in tinting strength to conform to a minimum standard. T. Pamer will look at some other prints and determine if some standard curves can be established. Volunteers will be needed for preparation of draw-downs and color readings.

D01.57.07, Physical Properties of Artists' Materials, H. W. Levison, Chairman. Draft 4—"Standard Test Method for Yellowing of Artists' Paint Vehicles in an Indoor Environment" was circulated. This document will be checked for proper wording prior to being sent out for ballot.

H. W. Levison circulated a lengthy report, "Review of Tests Reported Under Project D01.57.07." This report lists all documents submitted and summarizes the data gathered in this project.

Revision of D 4236—Draft 13 of the "Practice for Labeling Art Materials for Chronic Health Hazards" has been balloted on Main and Subcommittee ballot. There were three negatives cast, and all of the negatives have been withdrawn. At the Planning Committee Meeting, editorial comments were considered and incorporated into Draft 13. Still undecided is whether this document should be called a "practice" or a "specification." It was the subcommittee's feeling that either term would be acceptable. The chairwoman will consult with ASTM and reach a conclusion as to the use of "practice" or "specification."

Amended Draft 13 will now be prepared for Society ballot. This would mean that, if Draft 13 is approved, the revised document would be available in hard cover form very soon.

"Standard Specification for Artists' Oil and Acrylic Emulsion Paints" has been balloted at the subcommittee and committee levels. A negative was received from H. Ashton concerning the use of the term "emulsion" rather than "latex" in the title of the document as well as in other places in the document. It was the general opinion of the Subcommittee that

"emulsion" is the vernacular of the trade and that "latex" would not be an acceptable term for these products. A motion was passed to vote this negative non-pursuasive.

At the Planning Committee meeting, editorial comments were considered and an amended Draft 7 was prepared. The subcommittee chairwoman then read the amended sections, and asked for comments on the amendments. A motion was passed to accept the amended version of Draft 7.

Also discussed at the Planning Committee meeting, were several revisions in the specifications. These revisions were read by the chairwoman and discussed by the Subcommittee.

Section 5.1.7—Mixed Pigments—to be changed to read: "Paints that contain more than one pigment conform to this specification if all pigments in the paint are on the suitable pigment list in Table I and provided the mixture itself has passed all other test requirements in this specification. These paints shall carry the Lightfastness Rating of the least lightfast pigment in the paint. The lightfastness category of these paints may be changed after they have been tested for lightfastness in accord with D____, and the data indicating a lightfast rating is suitable to submit to the Subcommittee for evaluation."

Section 5.3.3—Pigments were placed in a lightfastness category on the basis of either known historical performance in art works or the ratings from four lightfastness tests conducted as described in D____. Data from further tests on these, or other pigments, are solicited by Sub. D01.57.

Section 5.3.3.1—The lightfastness category of a pigment shall be changed if results from several further tests conducted in accordance with D____ and approved by Sub. D01.57, indicate a different lightfastness category than the one given in Table I.

Section 5.3.3.2—Additional pigments shall be placed in Table I after they have been tested for lightfastness in accordance with D____ and the data submitted to Sub. D01.57 for evaluation, provided the test results demonstrate that the pigments have the lightfastness ratings required for Lightfastness I or Lightfastness II, as described above.

Section 5.6—Statement of Conformance—"Conforms to ASTM Specification D____." Producers are encouraged to provide full descriptive material about their products in their technical literature or catalogues.

Section 5.6.1—Objection to "see our literature" as a requirement to be on labels for conformance. There has been much confusion as to the meaning of this statement. A motion was approved to eliminate "see our literature" as a requirement and add the following statement to the specification. "Producers are encouraged to provide full descriptive material about their products in their technical literature or catalogues."

A revision of the proposed draft will be prepared.

DIVISION 60
PAINT APPLICATION

SUBCOMMITTEE D01.61
MANUAL PAINT APPLICATORS

F. B. Burns, Chairman

This was the first meeting of this new subcommittee. It was agreed that the initial focus of the subcommittee would be directed to "Criteria for State and Institutional Purchasing of Commercial Paint Applicators." The lack of industry or ASTM test methods was discussed and it was concluded that this would be an essential foundation to be developed.

D01.61.01, Paint Brushes, W. V. Moseley, Jr., Chairman, discussed the problem of purchasing commercially available brushes. It was decided that a list of valid test procedures and definitions would be drawn up by F. B. Burns for presentation at the next meeting. The group chairman will survey the state government purchasing agents to obtain their methods for purchasing brushes. Burns will see that the brush industry is informed of the progress of this group and subcommittee. Chairman Moseley will do the same with the state and federal agencies.

D01.61.02, Paint Rollers, J. F. Price, Chairman, discussed the objectives of the task group. It was decided that the group chairman should prepare a list of objectives relative to necessary definitions, standards, and test procedures and submit them at the December D-1 meeting.

Filtration Procedures Used in the Resin Manufacturing Industry

(Continued from page 16)
situations where series filtration was used, the vast majority consisted of a filter press preceded or followed by a bag.

The set-up for block press filtration breaks down as follows:

	%
Perforated screen and 1 sheet of paper	46.1
Perforated screen and 2 sheets of paper	15.4
Canvas and 1 sheet of paper	15.4
Canvas—no paper	7.7
Screen—no paper	7.7
Canvas—Perforated screen	7.7
2 sheets of paper	00.0
1 sheet of paper	00.0
Canvas and 2 sheets of paper	00.0

The majority of cartridge ratings preferred were 5, 10, 25, and 50 microns. A complete summary is listed below.

Rating	%
10 Micron	24.1
25 Micron	20.7
50 Micron	13.8
5 Micron	13.8
100 Micron	10.3
1 Micron	6.9
200 Micron	3.4
125 Micron	3.4
75 Micron	3.4

In situations where filter bags are used, 10, 25, 50, and 100 micron bags account for the vast majority of ratings used. These bags are also used in approximately equal proportions.

To summarize the data, these general statements can be made:

(1) The majority of resins manufactured were alkyds.

(2) The bag, block press, and cartridge devices were the preferred methods for filtration. The block press and cartridge rated closely for clarity, filter rate, and lack of contamination; the bag was considered close, with the exception of clarity.

(3) The majority of manufacturers do not filter in a series; however, when series filtration is required, it consists of a bag/press set-up.

(4) Most block press manufacturers use a perforated screen and one sheet of paper.

(5) Preferred cartridge filter ratings are 5, 10, 25, and 50 micron.

(6) Preferred bag filter ratings are 10, 25, 50, and 100 micron.

1983-84 Officers of the Golden Gate Society for Coatings Technology are (left to right): Vice-President—Ken Trautwein; Treasurer—Bob Miller; Secretary—Sandy Lund; and President—Adrian Adkins

Southern Society Officers for the year 1983-84 (left to right): President—William G. Early; Vice-President—James E. Geiger; Secretary—Salvatore G. Sanfillippo; and Treasurer—Ronald R. Brown

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Eudowood Gardens, Towson, MD; FRANK GERHARDT, Bruning Paint Co., 601 S. Haven St., Baltimore, MD 21224. Virginia Section—Fourth Wednesday, Ramada Inn-East, Williamsburg, VA).

BIRMINGHAM (First Thursday—Westbourne Suite, Botanical Gardens, Birmingham). D. H. CLEMENT, Holden Surface Ctgs. Ltd., Bordesley Green Rd., Birmingham B9 4TQ. England.

CHICAGO (First Monday—meeting sites in various suburban locations). MARTIN F. BALOW, United Coatings, Inc., 3050 N. Rockwell Ave., Chicago, IL 60618.

C-D-I-C (Second Monday—Sept., Jan., Apr., June in Columbus; Oct., Dec., Mar., May in Cincinnati; Nov., Feb., in Dayton). BILL M. HOLLIFIELD, Perry & Derrick Co., Inc., P.O. Box 12049, Cincinnati, OH 45212.

CLEVELAND (Third Tuesday—meeting sites vary). SCOTT E. RICKERT, Case Western Reserve University, Cleveland, OH 44106.

DALLAS (Thursday following second Wednesday—Steak & Ale Restaurant). VAN G. FALCONE, Kuppers Co., 801 E. Lee St., Irving, TX 75060.

DETROIT (Fourth Tuesday—meeting sites vary). AL MOY, Glasurit America, Inc., P.O. Box 38009—Fenkell Station, Detroit, MI 48238.

GOLDEN GATE (Monday before third Wednesday—Alternate between Sabella's Restaurant on Fisherman's Wharf and Francesco's, Oakland, CA). SANDRA LUND, The O'Brien Corp., 450 E. Grand Ave., S. San Francisco, CA 94080.

HOUSTON (Second Wednesday—Sonny Look's, Houston, TX) ARTHUR MCDERMOTT, Nalco Chemical Co. P.O. Box 87, Sugarland, TX 77478.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). H. DENNIS MATHES, Cook Paint & Varnish Co., P.O. Box 389, Kansas City, MO 64141.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). HENRY J. KIRSCH, Trans Western Chemicals, 7240 Crider Ave., Pico Rivera, CA 90660.

LOUISVILLE (Third Wednesday—Breckinridge Inn, Louisville, KY). JOYCE SPECHT, Porter Paint Co., 400 S. 13th St., Louisville, KY 40203.

MEXICO (Fourth Thursday—meeting sites vary). GEORGE CARRINGTON, Nuodex Mexicana, Mexico, D.F., Mexico.

MONTREAL (First Wednesday—Bill Wong's Restaurant). JEAN BRUNET, Van Waters & Rogers Ltd., 2700 Jean Baptist Deschamps, Lachine, Que., Can., H8T 1E1.

NEW ENGLAND (Third Thursday—Hillcrest Function Facilities, Waltham). MAUREEN M. LEIN, Raffi & Swanson, Inc., 100 Eames St., Wilmington, MA 01887.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). RAYMOND P. GANGI, Woolsey Marine, 183 Lorraine St., Brooklyn, NY 11231.

NORTHWESTERN (Tuesday after first Monday—Boulevard Cafe, Golden Valley, MN). ALFRED F. YOKUBONIS, Celanese Specialty Resins, 5008 W. 99th St., Bloomington, MN 55437.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). GERALD MCKNIGHT, Lilly Industrial Coatings, 619 S.W. Wood St., Hillsboro, OR 97123.

PHILADELPHIA (Second Thursday—Dugan's Restaurant). ROBERT L. TOZER, Delkote, Div. of Lilly Ind. Coatings, Inc., 76 S. Virginia Ave., Penns Grove, NJ 08069.

PIEDMONT (Third Wednesday—Howard Johnson's, Brentwood exit of I-85, High Point, NC.) MICHAEL DAVIS, Paint Products Co., Inc., P.O. Box 648, Walkertown, NC 27051.

PITTSBURGH (First Monday—Skibo Hall, Carnegie Mellon Univ.). JOSEPH MASCIA, Campbell Chemical Co., P.O. Box 11182, Pittsburgh, PA 15237.

ROCKY MOUNTAIN (Monday following first Wednesday—Bernard's, Arvada, CO). CARWIN BEARDALL, Howells, Inc., 4285 S. State St., Salt Lake City, UT 84107.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant). CHARLES L. GRUBBS, Rockford Coatings Corp., 1825 Ave. H, St. Louis, MO 63125.

SOUTHERN (Gulf Coast Section—Various Dates; Central Florida Section—Third Thursday after first Monday; Atlanta Section—Third Thursday; Memphis Section—Second Tuesday; Miami Section—Tuesday prior to Central Florida Section). S.G. SANFILIPPO, Reichhold Chemicals, Inc., Technical Services Lab., P.O. Box 1610, Tuscaloosa, LA 35401.

TORONTO (Second Monday—Cambridge Motor Hotel). GORDON MAJOR, Mactac Canada Ltd., 100 Kennedy Rd., S., Brampton, Ont., Can., L6W 3E8.

WESTERN NEW YORK (Third Tuesday—The Red Mill, Clarence, NY). CHARLES C. TABBI, Spencer-Kellogg Div., Textron, Inc., P.O. Box 210, Buffalo, NY 13319.

Future Society Meetings

Baltimore

(Nov. 17)—AWARDS BANQUET.

(Jan. 19)—Speaker from Universal Color Systems.

(Feb. 16)—EDUCATIONAL COMMITTEE PRESENTATION.

(Mar. 15)—SOCIAL COMMITTEE NIGHT.

(Apr. 19)—TECHNICAL STEERING COMMITTEE PROGRAM.

(May 17)—ANNUAL BUSINESS MEETING AND ELECTION OF OFFICERS.

(June)—JOINT OUTING WITH BPCA.

Birmingham

(Nov. 24)—LADIES' LECTURE. "AN ANTHOLOGY OF COLOR"—Dr. D.J. Griffiths, Leeds University.

(Dec. 1)—"COLOR MEASUREMENTS BY COLORIMETERS"—Dr. D.A. Plant, Consulting Scientist.

(Jan. 12)—"THE TECHNICAL DEPARTMENT—A DRAIN ON RESOURCES OR AN AID TO PROFITABILITY"—Dr. P.P.W. Weiss, Croda Paints.

(Feb. 2)—"MONITORING LEAD IN PAINT PRODUCTION"—A.C.D. Cowley, Imperial Chemical Industries PLC.

(Mar. 1)—"POWDER COATINGS MANUFACTURING METHODS PRESENT AND FUTURE"—E.W. Byerley, Byerley Machinery Sales.

(Apr. 5)—"SATURATED POLYESTER DEVELOPMENTS FOR THE INDUSTRIAL PAINT INDUSTRY"—B. Langdon, Dynomit U.K. Ltd.

(May 3)—"Trends in Automotive Finishes"—R. Hurn, Ford Motor Co. Ltd.

Chicago

(Jan. 9)—"SOLVENT RECYCLING"—Richard Schlack, Hydrite Chemical. "DIATOMITE—FOR THE COATINGS INDUSTRY"—Thomas E. Remmers, Manville Products Corp.

(Feb. 6)—"ORGANO CLAYS: A NEW LOOK AT A MATURE PRODUCT"—Thomas W. Powell, Jr., United Catalysts, Inc. "LIGHT SCATTERING EXTENDERS"—Craig J. Stoneback, Englehard Corp.

(Mar. 5)—"OVERVIEW AND CONCEPTUAL DESIGN OF A MODERN PAINT DEPARTMENT"—Thomas Daly, Ace Paint Div. "ILLINOIS ENVIRONMENTAL REGULATIONS AS THEY AFFECT COATINGS"—Karl Franson, Illinois E.P.A.

(Apr. 2)—"COLLOIDAL SILICA—A UNIQUE PIGMENT"—R. Thornton, Nalco Chemical Co. "ROLE OF ADDITIVES IN THE '80'S"—E. Antonucci, Drew Chemical Co.

(Apr. 27)—AWARDS NIGHT.

Golden Gate

(Nov. 14)—"NEW SUPER DISPERSABLE ORGANO-CLAYS FOR HIGH PERFORMANCE COATINGS"—Alfred J. Whitton, NL Chemicals/NL Industries, Inc.

(Jan. 17)—"A PRACTICAL APPROACH TO UNDERSTANDING EMULSIONS"—P.J. McDonald, Reichhold Chemicals, Inc.

(Mar. 14)—"INDUSTRIAL FINISHES—WATER OR HIGH SOLIDS, OR BOTH"—R.N. Benton, Spencer Kellogg Div. of Textron, Inc.

(Apr. 18)—"DISPERSION OF TiO_2"—V.R. Pedersen, Tioxide Canada, Inc.

(May 16)—"THE PROPER SOFTWARE FOR YOU"—L.S. Feldman, Sinclair Paint Co.

Los Angeles

(Jan. 11)—"A PRACTICAL APPROACH TO UNDERSTANDING EMULSIONS"—P.J. McDonald, Reichhold Chemicals, Inc.

(Feb. 8)—LADIES NIGHT.

(Mar. 14)—PAST PRESIDENTS' NIGHT. "INDUSTRIAL FINISHES—WATER OR HIGH SOLIDS, OR BOTH"—R.N. Benton, Spencer Kellogg Div. of Textron, Inc.

(Apr. 11)—MANUFACTURING SEMINAR/BOSSES' NIGHT. "DISPERSION OF TiO_2"—V.R. Pedersen, Tioxide Canada, Inc.

(May 9)—AWARDS NIGHT. "THE PROPER SOFTWARE FOR YOU"—L.S. Feldman, Sinclair Paint Co.

(June 13)—ANNUAL MEETING/ELECTION OF OFFICERS. TECHNICAL COMMITTEE PROGRAM.

Montreal

(Dec. 7)—"THE SOLVENT OPTION FOR AIR QUALITY COMPLIANCE"—R.M. Oteiza, The Dow Chemical Co.

(Jan. 11)—"COATINGS AND THE DEPARTMENT OF NATIONAL DEFENSE"—A. Afzal, Department of National Defense.

(Feb. 8)—"INFLUENCE OF SURFACE PREPARATION UPON PERFORMANCE OF PROTECTIVE COATINGS IN ATMOSPHERIC ENVIRONMENTS"—John D. Trim, Corrosion Service Co., Ltd. Joint Meeting with N.A.C.E.

(Feb. 14)—SYMPOSIUM—"UPDATE ON TRANSPORTATION COATINGS."

(Mar. 7)—Technical Committee's Presentation, "COLOR ACCEPTANCE"—Steve Velente.

(Apr. 4)—"A PRACTICAL APPROACH TO UNDERSTANDING EMULSIONS"—P.J. McDonald, Reichhold Chemicals, Inc.

(May 2)—MANUFACTURING COMMITTEE'S PRESENTATION.

New York

(Nov. 15)—"APPLICATION FOR WATER-BORNE INDUSTRIAL FINISHES"—Richard M. Benton, Spencer Kellogg Div., Textron, Inc.

(Dec. 10)—LADIES' NIGHT.

(Jan. 10)—"PROPELLOR AND TURBINE MIXERS"—Frank H. Tatreau, MixMor, Inc.

(Feb. 9)—LEGISLATIVE UPDATE AND JOINT MEETING WITH NYPCA.

(Mar. 13)—FEDERATION OFFICERS' VISIT.

(Apr. 10)—Subject to be announced.

(May 8)—PAVAC NIGHT.

Pacific Northwest

(Nov. 15)—"NEW SUPER DISPERSABLE ORGANO-CLAYS FOR HIGH PERFORMANCE COATINGS"—Alfred J. Whitton, NL Chemicals/NL Industries, Inc.

(Jan. 18)—"A PRACTICAL APPROACH TO UNDERSTANDING EMULSIONS"—P.J. McDonald, Reichhold Chemicals, Inc.

(Mar. 15)—"INDUSTRIAL FINISHES—WATER OR HIGH SOLIDS, OR BOTH"—R.N. Benton, Spencer Kellogg Div. of Textron, Inc.

(Apr. 19)—"DISPERSION OF TiO_2"—V.R. Pedersen, Tioxide Canada, Inc.

(May 17)—"THE PROPER SOFTWARE FOR YOU"—L.S. Feldman, Sinclair Paint Co.

Philadelphia

(Dec. 8)—"SMALL MEDIA MILLING—COST EFFECTIVENESS"—Leo Dombrowski, Chicago Boiler Co.

Piedmont

(Nov. 16)—"EMULSION POLYMERIZATION TECHNOLOGY"—Dr. Ben Kline, Rohm and Haas Co.

(Dec. 21)—"PHOTOGRAPHY—THE HOBBY AND YOU"—Walter Dove, Fisher Harrison Corp.

(Jan. 18)—"LABORATORY CALCULATION TECHNIQUE AND THE PAINT CHEMIST"—James T. Degroff, Applied Color Systems, Inc.

(Mar. 21)—"PAINT EXAMINATION TECHNIQUES UTILIZED IN THE FBI LABORATORY"—James E. Corby, Federal Bureau of Investigation.

Pittsburgh

(Dec. 5)—JOINT MEETING WITH THE PPCA. "SUPERFUND AND OTHER ENVIRONMENTAL REGULATIONS"—Thomas Graves, NPCA.

(Jan. 9)—PAST-PRESIDENTS' NIGHT AND 25-YEAR PINS. "MORE EFFICIENT INDUSTRIAL PAINTING"—Carl Izzo, Westinghouse Electric Corp.

(Feb. 6)—JOINT MEETING WITH THE PITTSBURGH CHAPTER OF THE NATIONAL ASSOCIATION OF CORROSION ENGINEERS.

(Mar. 5)—"TRENDS IN FUTURE COATINGS"—Dr. Marco Wismer, PPG Industries, Inc.

(Apr. 2)—"EFFECT OF SURFACE TENSION AND VISCOSITY ON SURFACE DEFECTS IN COATINGS"—Cliff Schoff, PPG Industries, Inc.

(May 7)—"INS AND OUTS OF TiO_2"—Richard Ensminger, NL Industries.

Rocky Mountain

(Jan. 10)—"A PRACTICAL APPROACH TO UNDERSTANDING EMULSIONS"—P.J. McDonald, Reichhold Chemicals, Inc.

(Mar. 7)—"INDUSTRIAL FINISHES—WATER OR HIGH SOLIDS, OR BOTH"—R.N. Benton, Spencer Kellogg Div. of Textron, Inc.

(Apr. 11)—"DISPERSION OF TiO_2"—V.R. Pedersen, Tioxide Canada, Inc.

(May 9)—"THE PROPER SOFTWARE FOR YOU"—L.S. Feldman, Sinclair Paint Co.

St. Louis

(Nov.15)—"CURRENT USE AND TRENDS IN ACCELERATED WEATHERING TESTS"—Ray Mitzenger, Atlas Electric Devices Co.

(Dec. 20)—JOINT CHRISTMAS MEETING.

(Jan. 17)—"A LOOK AT THE COLORANT PILOT PLANT PRODUCTION AND THE MAKE-UP, USAGE, AND ADVANTAGES OF COLORANTS"—Dr. Marty Feldman, Nuodex Inc.

(Feb. 21)—LADIES' NIGHT.

(Mar. 20)—FEDERATION VISIT.

(Apr. 17)—TEACHERS' NIGHT.

(May 15)—MANUFACTURING NIGHT.

Toronto

(Nov. 14)—"A PRACTICAL APPROACH TO UNDERSTANDING EMULSIONS"—Patrick J. McDonald, Reichhold Chemicals, Inc.

Technical Articles in Other Publications

Compiled by the Technical Information Systems Committee—H. Skowronska, Chairman

The periodicals cited may be obtained from the listed publisher, or may be consulted at various libraries. Will you please consult the CHEMICAL ABSTRACTS SOURCE INDEX or the UNION LIST OF SERIALS/NEW SERIALS at your nearest library to find the public and/or college-university library where these periodicals are available.

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Boberski, W.G., Seiner, J.A., and Blasko, J.E.—"Enhanced Water Insensitivity of Alkali Silicate Coatings by Use of Metal Compounds"; 528 +.

Boberski, W.G., Seiner, J.A., and Petracca, V.G.—"Reducing the Viscosity of Magnesia Cements with Organosilicon Compounds"; 531 +.

Capps, R.N., Bush, I.J., Lieberman, S.T., and Eveland, S.E.—"Evaluation of Environmental Effects on Candidate Polymeric Materials for Underwater Optoacoustic Sensors"; 540 +.

Monaco, S.B., Richardson, J.H., Breshears, J.D., Lanning, S.M., Bowman, J.E., and Walkup, C.M.—"Stress Chemiluminescence of Polymeric Materials; Predictive Applications to the Aging Process"; 546 +.

Gutek, B.I. and VanWert, B.—"Silicone Resin Coatings for Glass Cloth Used in Fabric Structures"; 601 +.

Bauer, D.R., Briggs, L.M., and Dickie, R.A.—"Effect of Crosslinked Polymeric Microparticles on the Rheology of High-Solids Coatings"; 686 +.

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Glassner, L.S. Dent, Lachowski, E.E., and Murray, L.W.—"Reactive Pigments in Inorganic Silicate Coatings"; 1 +.

Jada, S.S.—"Role of Polymer-Bound Metals and Amine in Polycondensation and Copolymerization Processes of Polyester Resins"; 14 +.

Cella, J.A., Schwabacher, A.W., and Shulz, A.R.—"Cationic Chelate Salts of Main Group Elements as Curing Agents for Epoxy Resins"; 20 +.

Springle, W.R.—"Evaluation of Latex Paint Preservatives: A Comparative Method and a Quantitative Treatment of Bacterial Behavior in Paint Test Systems"; 61 +.

Smith, R.E.—"Dynamic Surface Tension Measurements of Coatings"; 67 +.

Hughes, M.C., Leidheiser, H., Jr., Chou, S-M, and Bilder, W.—"Wear Rates of Anodized Aluminum and Polymer Coatings as Model Systems for Lithographic Printing Plates"; 132 +.

Messadi, D., Taverdet, J.L., and Vergnaud, J.M.—"Plasticizer Migration from Plasticized Poly(vinyl chloride) Into Liquids. Effect of Several Parameters on the Transfer"; 142 +.

Piccarolo, S. and Titomanlio, G.—"Thermodynamic Behavior of Single Polymer-Binary Solvent Systems. Qualitative Comparison with Solubility Parameter Approach"; 146 +.

Vol. 22, No. 2 June 1983

Barar, D.G., Staller, K.P., and Peppas, N.A.—"Friedel-Crafts Crosslinking Methods for Polystyrene Modification. 3. Preparation and Swelling Characteristics of Crosslinked Particles"; 161 +.

deVries, J.E., Holubka, J.W., and Dickie, R.A.—"X-ray Photoelectron Spectroscopy Study of Corrosion-Induced Paint Adhesion Loss on Conversion-Coated Steel"; 256 +.

LaLiberte, B.R., Bornstein, J., and Sacher, R.E.—"Cure Behavior of an Epoxy Resin—Dicyandiamide System Accelerated by Monuron"; 261 +.

Metzger, M. and Fishman, S.G.—"Corrosion of Aluminum—Matrix Composites"; 296 +.

Organic Coatings & Applied Polymer Science Proceedings

Preprints of Papers Presented by ACS Division of Organic Coatings And Plastics Chemistry at ACS National Meeting, March 1983, Seattle, WA

Vol. 48 March 1983

Recent Developments in Adhesive Chemistry
- Chemistry of adhesion (5 papers)
- Physics of adhesion (6 papers)
- Radiation-curable adhesives (5 papers)
- High-temperature adhesives (6 papers)
- Anaerobic and structural adhesives (6 papers)

Basics of biomedical polymers (3 papers, tutorials)

Polymers in Electronics
- Photoresists (8 papers)
- Electron beam resists (8 papers)
- Polyimides, dielectrics, and encapsulants (9 papers)
- Device application (7 papers)
- Conductive polymers (8 papers)
- General papers (11 papers)

Phillips Award Symposium in Applied Polymer Science: NMR of Polymers—Recent Advances in high resolution solution and solid state studies (11 papers)

Plastics and Artificial Organs
- Artificial organ design and biomaterials (4 papers)
- Biocompatibility factors (6 papers)
- Cardiovascular applications (5 papers)
- Surface and membrane phenomena (5 papers)

Elements of successful research projects leading to innovation and new products (8 papers)

Characterization of highly crosslinked polymers (26 papers)

General papers and new concepts in polymeric materials (20 papers)

Recent advances in Size Exclusion Chromatography
- Size exclusion and related chromatography methods (7 papers)
- Copolymer, branching, and crosslink network analysis (7 papers)
- Calibration, instrument spreading corrections and data treatment (7 papers)

Operational variable studies, column technology and oligomer analysis (6 papers)

Fiber-reinforced polymeric composites for structural use (14 papers)

Inquiries regarding the price and availability of this publication should be sent to American Chemical Society, 1155—16th Street, NW, Washington, DC 20036.

Polymer Preprints

Preprints of Papers Presented by ACS Division of Polymer Chemistry At ACS National Meeting, March 1983, Seattle, WA

Vol. 24, No. 1 March 1983

Polymers as biomaterials: new polymeric biomaterials (46 papers)

Diffusion in polymers (15 papers)

Control of polyolefin structure and properties (12 papers)

Special topics—Poster session (25 papers)

Symposium on ACS Award in Polymer Chemistry honoring Richard S. Stein (Rheo-optical studies of polymers) (17 papers)

Polymer Science and Engineering Lecture Series No. 7—Introduction to Composite Interfaces (2 papers)

Polymer Composites: Interfaces
- Influence of interfaces on physical properties of composites (6 papers)
- Molecular structure of coupling agents and interfaces (7 papers)
- Influence of interfaces on matrix structure (6 papers)
- Surfaces of reinforcements (8 papers)

Symposium on ACS Award for Creative Invention honoring O.A. Battista (Research for profit) (4 papers)

Special topics in polymer chemistry (16 papers)

Inquiries regarding the price and availability of this publication should be sent to Frederick Damoni, ACS Division of Polymer Chemistry, PO Box 20453, Newark, N.J. 07101.

Progress in Organic Coatings

Published by Elsevier Sequoia S.A., P.O. Box 851, 1001 Lausanne 1, Switzerland.

Vol. 11 No. 1 1983

Maeda, S.—"Steel Surface Chemistry Affecting the Performance of Organic Coatings"; 1-18.

Leidheiser, H., Jr., Wang, W., and Igetoft, L.—"Mechanism for the Cathodic Delamination of Organic Coatings from a Metal Surface"; 19-40.

Troitzsch, J.H.—"Methods for the Fire Protection of Plastics and Coatings by Flame Retardant and Intumescent Systems"; 41-70.

Dowbenko, R., Friedlander, C., Gruber, G., Prucnal, P., and Wismer, M.—"Radiation Curing of Organic Coatings"; 71-104.

Vol. 11 No. 2 1983

Liska, V.—"Chemorheological Studies of Epoxide Resin Curing"; 109-138.

Touissant, A. and Dhont, L.—"Rheological Biparabolic Model Application to Study of Mechanical Properties OC Coatings; Application to Elastic Modulus"; 139-166. (in French)

Krishnamurti, N.—"Water-Soluble Epoxy Resins for Surface Coatings"; 167-198.

Meetings/Education

Color Science Symposium to Be Sponsored by RIT, February 16–17

"Frontiers in Color Science," a two-day symposium on color science, will be held at the Munsell Color Science Laboratory at Rochester Institute of Technology (RIT), February 16–17.

Organized by Dr. Franc Grum, RIT's Richard S. Hunter Professor in Color Science, Appearance, and Technology, the program will include presentations by 10 internationally-known authorities in color science.

The following topics and speakers are included in the program:

"History of Color Measurement"—W. David Wright, of Great Britain.

"Development of CIE Standards and Their Limitations"—Gunter Wyszecki, of Ottawa, Canada.

"A System of Photometry and Colorimetry Based on Cone Excitations"—Robert M. Boyton, of San Diego, CA.

"Photometry and the Human Observer"—Peter K. Kaiser, of York, Canada.

"Industrial Applications of Color Sciences"—Fred W. Billmeyer, Jr., Rensselaer Polytechnic Institute.

"Fluorescence and Its Measurement"—Dr. Grum.

"Color Order Systems"—David MacAdam, of Rochester, NY.

"Color Reproduction"—Milton Pearson, RIT.

"Applications of Color Order Systems"—Gunnar Tonnquist, Stockholm, Sweden.

"Color Appearance in Color Reproductions"—Robert W.G. Hunt, of Great Britain.

The symposium will inaugurate the Munsell Color Science Laboratory, which was established by RIT when the Board of Directors of the Munsell Foundation dissolved the foundation and turned its assets into the creation and maintenance of the Laboratory. C. James Bartleson, of Eastman Kodak Co., and Richard S. Hunter, of Hunter Associates Laboratory, will speak during inauguration ceremonies for the Laboratory.

Registration fee for the symposium is $100 and attendance is limited to 100 participants.

There will be no written proceedings published of the symposium.

Further information may be obtained from Dr. Franc Grum, School of Photographic Arts and Sciences, Rochester Institute of Technology, P.O. Box 9887, Rochester, NY 14623.

Participants Sought for ASTM Task Group On Zinc Rich Coatings

Additional participants are sought for a task group established by ASTM Subcommittee D01.48 on Zinc Rich Coatings. The task group, which is seeking members from paint making and construction industries, has begun work on establishing methods for the determination of cure, porosity, and volume solids as well as on laboratory methods of test including the Circle Test and V-Knotch Test. The work of the task group will benefit coatings producers and painting contractors.

As proposed at the January 25, 1983 meeting, the main scope of Subcommittee D01.48 is to develop and adapt laboratory test methods and field guides to evaluate zinc rich coatings for degree of cure, effective coverage rate, film integrity, acceptance of topcoats, degree of galvanic protection of steel substrates, and other properties required to achieve the intended performance of zinc-rich coating systems.

Subcommittee D01.48 is under the auspices of Committee D-1 on Paint and Related Coatings and Materials which develops test methods, definitions, practices, specifications and classifications for paint, varnish, lacquer, printing ink, and other related coatings and materials.

For more information on Subcommittee D01.48 and its task group work, contact, David Kinder, ASARCO, Inc., P. O. Box 327, Columbus, OH 43216, 614/294-5566; or Phil Lively, ASTM Standards Development Div., 1916 Race St., Philadelphia, PA 19103, 215/299-5481.

CALL FOR PAPERS

"Water-Borne and Higher-Solids Coatings" Symposium
New Orleans, LA
February 7-9, 1984

The Southern Society for Coatings Technology and the Department of Polymer Science at the University of Southern Mississippi invite all interested persons to submit papers for presentation at the 11th Annual Water-Borne and Higher-Solids Coatings Symposium.

Papers relating to the chemistry, formulation, and marketing of water-borne, higher solids and other advanced coating systems are solicited. Papers relating to engineering aspects of coating systems or solvent abatement are also solicited.

Title and abstract should be submitted by November, 1983, to:

Dr. Gordon L. Nelson, Chairman Department of Polymer Science, University of Southern Mississippi Hattiesburg, MS 39406-0076.

The completed paper should be submitted by December 31, 1983. Papers to be presented at the Symposium will be chosen based on abstracts.

It is preferred that all papers be original and of scientific value.

Symposium on Vinylidene Chloride Presented by UMR in St. Louis, MO

"Vinylidene Chloride, a Monomer for the '80s," a 2½-day symposium, was presented by the University of Missouri-Rolla chemistry department, November 9-11 in the new Breckenridge Concourse Hotel, St. Louis, MO.

Papers were presented on monomer characteristics, storage and handling, safety and use, toxicology and control of stability, economics, environmental impact, and formulations to take advantage of properties built into polymers. A section was devoted to copolymerization by emulsion and solution techniques using computer programs to predict polymer compositions.

The symposium was directed by John A. Gordon Jr., of the UMR chemistry faculty. Dr. James O. Stoffer, UMR Professor of Polymer Chemistry, and Violette Stevens, Technology Coordinator, Dow Chemical Co., served as co-chairpersons.

According to Dr. Gordon, vinylidene chloride is an affordable, available monomer for the production of polymers and copolymers with desirable properties. "Vinylidene chloride was first introduced as a commercial monomer in the 1940s," he explained. "Early development and uses centered around the high vinylidene chloride copolymers, which had the combination of good mechanical properties, outstanding barrier characteristics, chemical and solvent resistance, and low flammability. These were used in plastic pipe, film packaging, adhesives and specialty coatings. However, acrylic and vinyl acrylic polymers that were coming into the marketplace at that time diverted efforts from vinylidene chloride-containing copolymers. As a result, this excellent monomer has been neglected in coatings and other industries.

"Changes in technology, economics and the regulatory climate, coupled with continuing advances in polymer science, prompts a new investigation of vinylidene chloride as a modifying monomer for the polymers and copolymers of the '80s," he added. "This symposium gave participants an opportunity to update their knowledge of vinylidene chloride as well as to discuss general subjects and to explore specific problems in private discussions with people experienced in the coatings field."

CALL FOR PAPERS

"Maintenance Painting of Industrial Plants"
Symposium
September, 1984
Pittsburgh, PA

The Steel Structures Painting Council is tentatively scheduling a symposium entitled "Maintenance Painting of Industrial Plants" for September 1984, in Pittsburgh, PA. The symposium will be held in conjunction with the SSPC Annual Meeting and with exhibits by manufacturers, consultants, and technical societies relating to coatings programs for industrial plants.

The symposium and exhibit are designed to assist plant engineers in developing and maintaining successful coatings programs.

In broad outline, the symposium will deal with:

(a) Creating an Independent Coatings Program,
(b) Developing a Consultant-Aided Coatings Program,
(c) Supplier-Centered Coatings Programs, and
(d) The Role of the Technical Society in Assisting with Coatings Programs.

Within these four general areas, papers will deal with cost-effectiveness, materials selection, specifications, contracting, surface preparation, recordkeeping, quality control, inspection, application, and other topics.

Exhibitors, including paint manufacturers, consultants, and technical societies, are expected to illustrate the means by which they can assist plant maintenance engineers in developing a successful coatings program.

Papers are being sought from administrators of coatings programs in industrial plants, as well as from consultants, contractors, engineers, and suppliers. The papers may include:

- case histories about successful coatings programs
- ways to estimate costs, cost-benefit analyses, and cost-effectiveness of a coatings program
- contractural innovations
- the application of new technology in protective coatings programs
- how to establish a protective coatings program

Persons wishing to submit abstracts or exhibit at the 1984 SSPC meeting should write to Harold E. Hower, SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213.

ASTM Standard for Prepainted Sheet Flexibility Is Approved

The flexibility of painted metal sheets that are fabricated into building siding, guttering, and other such products can now be determined through a standard test method recently developed by ASTM Committee D-1 on Paint and Related Coatings and Materials.

Subcommittee D01.53 on Factory-Precoated Strip Metal is directly responsible for the creation of Standard D4145, Test Method for Coating Flexibility of Prepainted Sheet. According to Robert A. Cassel, Chairman of the Subcommittee, the standard describes a method for bending prepainted panels around progressively more thicknesses of metal or larger diameter dies, and examining the panels for fracture of the coating.

D 4145 will be a direct aid to coil manufacturers, pretreatment industry representatives, tool cutters, and paint suppliers to the coil industry. Standard Document D 4145 is available for $4 from the ASTM Sales Services Dept., 1916 Race St., Philadelphia, PA 19103.

TO OUR READERS:

The JOURNAL OF COATINGS TECHNOLOGY welcomes any responsible views pertaining to the Coatings Industry, Federation activities, and the editorial content of the JCT. Letters should be brief and signed with the writer's address and company affiliation.

Correspondence should be addressed to: Letters to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 1315 Walnut St., Philadelphia, PA 19107.

People

Harry E. Ashton, Assistant Section Head of Building Materials for the National Research Council of Canada, Div. of Building Research, Ottawa, Ont., Canada, is the 1983 recipient of the William T. Pearce Award from the American Society of Testing and Materials.

Mr. Ashton was honored for his outstanding contributions to the advancement of voluntary standards at the June meeting of ASTM's D-1 Committee on Paint and Related Coatings Materials.

Mr. Ashton has been active in ASTM and Committee D-1 since 1965 and currently chairs the D-1 Subcommittee on Sampling and Statistics. In 1978 he received the ASTM Award of Merit and was named a Fellow of the Society. Mr. Ashton has also been a member of the Montreal Society for Coatings Technology since 1964, serving as a Director on the Executive Committee from 1966 to 1969. His activities with the Federation of Societies for Coatings Technology include being a member of the Research Applications Committee, 1970 to 1971, member of the Paint Industries Show Committee, 1974 to 1975, and member of the Editorial Review Board of the JOURNAL OF COATINGS TECHNOLOGY since 1982.

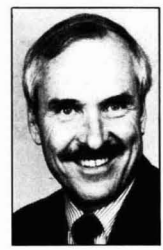
Thomas J. Gibbons has been appointed National Sales Manager of Arizona Chemical Co., Fair Lawn, NJ. Mr. Gibbons was formerly with the Process Chemical Div. of Diamond Shamrock Corp., and is a member of the New York Society.

Richard E. Max, of Synkote Paint Co., Elmwood Park, NJ, was presented with the New York Society's President's Service Award for his "long and faithful service to the Society" at the Society's September meeting. Mr. Max, currently chairman of the Federation's Manufacturing Committee, has been a member of the Society's Board of Directors, and Finance and Long Range, Joint Coordinating, Nominating, Special Events, Symposium, Technical, and Manufacturing Committees.

Louis J. Barta, Plant Manager of the W.C. Richards Co., Blue Island, IL, has been named Vice-President. Mr. Barta is a member of the Chicago Society and is a member of the board of directors of the CPCA.

H.E. Ashton

T.J. Gibbons



J.F. Calkin

R.S. Marderosian

The E.T. Horn Co., La Mirada, CA, has announced the appointment of **James F. Calkin** as Senior Account Manager in Southern California. Mr. Calkin has served the paint, coatings, adhesives, ink, and building products industries for over 17 years. He has held sales and management positions with Sherwin-Williams Co., NL Industries, Inc., Borden Chemical Co., and, most recently, with Reichhold Chemical Co. Mr. Calkin is a member of the Los Angeles Society.

J. Richard Kiefer, Jr. has been named Vice-President of Community, Industrial and Regulatory Affairs at McCloskey Varnish Co., Philadelphia, PA. Mr. Kiefer formerly served as Corporate Director of Environment, Safety and Health for the firm.

A Past-President of the Philadelphia Society, Mr. Kiefer serves as Honorary Director and Handbook Editor. He has been awarded its Liberty Bell and Technical Committee awards, as well as a special silver plate commemorating his completion of 19 consecutive years as an officer on the Executive Committee and Board of Directors.

James B. Knizley has been appointed to the position of Group Leader for Urethane Development by the CONAP Division, Olean, NY.

Cliff Loreth has been named Vice-President and General Manager of the Orrville (Ohio) Div. of Whittaker Coatings, Los Angeles. Mr. Loreth joined Whittaker in 1976.

Kevin Briggs was named Field Service Representative for the Chemical Coatings Division of The Sherwin-Williams Co. to serve product finishers in Michigan.

Robert S. Marderosian has been appointed Technical Sales Representative for New England Resins & Pigments Corp., Woburn, MA. He was formerly with Cypress Color & Chemical where he was a sales representative in the New England area. Mr. Marderosian is a member of the New England Society and served as chairperson for its "Coatings Tech Expo '82."

The appointment of Helzer Pacific, Inc., as Northwest sales representative has been announced by the Color Communications Group of Macbeth, a division of Kollmorgen Corp. Helzer Pacific, Portland, OR, is headed by **Norman V. Helzer,** President. Mr. Helzer is a member of the Pacific Northwest Society.

Burks, Incorporated, Atlanta, GA, has announced the appointment of **Robert V. Probeck** to its sales staff in the Tampa, FL operations. Mr. Probeck was previously associated with JB Sales & Consulting, Tierra Verde, FL. He is a Southern Society member.

Triad Sales Co., Anaheim, CA, has announced the appointment of **Rocky Courtain** as Manager of the sales office in San Jose, CA. Mr. Courtain was former Vice-President of Eiger Machinery, Inc. and former Regional Manager of Morehouse Industries. He is a member of the Los Angeles Society.

Sylvester J. Gorman, a former sales executive with the duPont Co., has joined Harry Gaffney & Co., Jenkintown, PA, in a sales capacity. Mr. Gorman retired from duPont earlier this year after 35 years with the Chemicals and Pigments Dept. in New York, Philadelphia, and Wilmington.

John F. Oster has been named Vice-President/Manufacturing Operations at McCloskey Varnish Co., Philadelphia, PA. Mr. Oster, who was previously Director of Corporate Manufacturing for McCloskey, has 34 years of industry experience. He will be responsible for production and operations at the firm's three plants. Prior to joining McCloskey earlier this year, Mr. Oster had served as manufacturing manager for Lawter International, Northbrook, IL, and managed a plant in Illinois for Cargill, Inc.

DSET Laboratories, Inc., Phoenix, AZ, has announced the promotions of **Matthew W. Rupp** to Vice-President and **Joseph S. Robbins, III** to Chief Engineer. In addition to remaining Manager of DSET's Marketing Division, Mr. Rupp has increased responsibilities that include development of new sales efforts, business planning activities, and administrative duties. Mr. Robbins, previously Supervisor in the Solar Division, is responsible for engineering evaluations and internal research and development operations.

Dennis M. Moldovan was promoted to the position of Manager of Development and Technical Sales Service for latex and coatings R&D at the Goodyear Tire & Rubber Company's latex plant in Galhoun, GA. Mr. Moldovan has had 15 years of experience in latex technology and previously served the firm as head of the latex applications section of its Chemical Research and Development Division, Akron, OH.

The Solvents and Coatings Materials Division of Union Carbide Corp. has announced the promotion of **David A. Ellwood** to Account Manager in the Baltimore, MD area. Mr. Ellwood previously served as Market Manager for pressure sensitive adhesives and industrial latexes. He will be based in the Moorestown, NJ sales office.

The promotion of **William F. Bergner** and **Jane C. Allen** to the positions of Sales Representatives has been announced by the Spencer Kellogg Division, Textron, Inc., Buffalo, NY.

Thomas E. Code has been named Southern District Sales Manager for the Coatings Division, Ferro Corp., Cleveland, OH. Mr. Code is responsible for all field sales operations of porcelain enamel coatings in the southern section of the United States.

David Viox has been named Sales Manager-Industrial Distributor for J.M. Huber Corp., Clay Division, Macon, GA. He replaced **James Marvin,** who has been transferred to the Huber Clay Division plant in Langley, SC, where he will work on special projects.

Robert Goldsmith was named Chemist in the general industrial/high technology customer service laboratory of the industrial colorants facility of United Technologies' Inmont Corp., Bound Brook, NJ.

Witco Chemical Corp. has announced the appointments of **C.W. Kimbrell** as Purchasing Agent and **Dalton L. Bennett** as Senior Buyer for the Memphis Region. Both men are based at the firm's Memphis, TN office.

The appointment of **A. Nurhan Becidyan** and **Mel Wilson** as Field Sales Manager for the Pigments and Additives Group was announced by Sandoz Colors and Chemicals, Charlotte, NC.

Literature

Dioxides

Literature is available announcing the development of two new controlled-structure, fine-particle, synthetic-precipitated silicon dioxides. Application uses in resins, epoxies, trade sales paints, coil coatings, industrial finishes, and varnishes for both water- and oil-base systems are discussed. For information, write J.M. Huber Corp., Chemicals Div., P.O. Box 97, Havre de Grace, MD 21078.

Catalyst Modifier

An eight-page booklet on the use of 2,4-pentanedione (acetyl acetone) as a catalyst modifier has been issued. Applications of pentanedione are discussed as are its uses. Information is provided on storage, handling, and shipping of pentanedione. "2,4-Pentanedione Catalyst Modifier" can be obtained from Union Carbide Corp., Specialty Chemicals Div., Dept. K3446, Danbury, CT 06817.

Proceedings

The Proceedings of the Ninth International Conference in Organic Coatings Science and Technology, which was held in July in Athens, Greece, is available. Some of the presentations featured in the Proceedings include: "Mechanism of Flow Control by Dispersed Polymer Particles in High Solids Paints," "Synthesis and Modification of Coatings by Plasma Techniques," "Aspects of Metal Pretreatment Before Painting," "Classes of Coatings, Applications and the Coatings Industry," "Opaque Polymers," "Crosslinking Surface Coatings," "Adsorption on Pigment Surfaces," and "Coatings Defects." A total of 21 presentations are featured in the Proceedings which is available for $100 in the U.S. and $150 in Europe. Contact Dr. Angelos V. Patsis, Conference Director, CSB, Room 209, State University of New York, New Paltz, NY 12561 for additional information.

MIBK Detector

A direct-reading methyl isobutyl ketone (MIBK) detector tube is featured in recent literature. Measuring capacities and applications uses in the manufacture of paint, varnish, and solvent are highlighted. For further information, contact Richard Townsend, The Bendix Corp., Environmental & Process Instruments Div., 12345 Starkey Rd., Largo, FL 33543.

Coatings Instrumentation

A new, condensed short-form catalog entitled, "Instrumentation for Coatings," is available. The literature illustrates a product line which includes coating thickness gauges, pin hole detectors, and additional related instruments. For more information, contact Frank Rueter, Vice-President Marketing, Zorelco Ltd., P.O. Box 25468, Dept. T-36, Cleveland, OH 44125.

Hazardous Waste

The Hazardous Waste Consultant, a bimonthly technical journal addressing the engineering, economic, and regulatory aspects of hazardous waste management, is being issued as a source of technical information for industry, consultants, design engineers, and government specialists. Each issue will include the following topics: hazardous waste technology, federal and state regulations, waste management economics, legal developments, and periodic updates on commercial disposal facilities, R&D projects, and Superfund sites. The journal may be obtained at an annual subscription price of $350 from McCoy and Associates, 13131 W. Cedar Dr., Lakewood, CO 80228.

Conductive Finishes

A new brochure detailing the compatibility of high-performance Polane® finishes and Electrodag® conductive coatings on plastic business machine enclosures is now available. "Total Coverage: Inside and Out" includes separate data sheets for each coating that describe individual formulations, list typical properties, and explain applications procedures and recommendations. Safety precautions and performance features are also detailed. For a copy of the literature, contact G.L. Holmberg, Chemical Coatings Div., Sherwin-Williams Co., 11541 S. Champlain Ave., Chicago, IL 60628.

Pump Exhaust Filters

A new line of stainless steel vacuum pump exhaust filters that completely remove oil mist and are designed for use with toxic or corrosive gases is highlighted in recent literature. For additional information, write Balston, Inc., 703 Massachusetts Ave., P.O. Box C, Lexington, MA 02173.

Disperser

A high speed disperser which disperses one large batch and then "lets it down" or tints the batch in different small batches is the subject of new literature. Information is available from Myers Engineering, 8376 Salt Lake Ave., Bell, CA.

Colorants

Literature is available introducing a new line of industrial colorants which are free of ethylene glycol based solvents. Application uses and advantages of the colorants are highlighted. For information, contact Nuodex, Inc., Turner Place, P.O. Box 365, Piscataway, NJ 08854.

Industry Analysis and Review

"The Paint and Coatings Industry: A Strategic Marketing Analysis and Biennial Review," which provides the most comprehensive marketing, economic, and financial investigation on the paint and coatings industry, has been published and is now available. Detailed coverage of the markets for all types of oil-based paints, water-based paints, OEM coatings, varnishes, stains, lacquers, industrial paints, and other related products is provided. Cost for the publication is $495 and is available from Business Trend Analysts, Inc., 2171 Jericho Turnpike, Commack, NY 11725.

Solvent Dispensing System

A multiple station solvent dispensing system, developed to consolidate the solvent containers, solvent dispensing valves, and measuring element air valves on one stand-alone panel, is featured in new literature. For additional information, write Norcross Corp., 255 Newtonville Ave., Newton, MA 02158.

Dispersions

Three new products in a line of Aquablak® carbon black dispersions have been introduced in recently published literature. Discussed are Aquablak 15A, which contains a pigment loading of 33% and a total solids of 36.8%; Aquablak 220, which exhibits fluid characteristics that make it very easy to use; and Aquablak 230, which is a non-flaking tinting black developed specifically for the coatings industry. For further information, contact Borden Chemical, Specialty Products Group, 630 Glendale-Milford Rd., Cincinnati, OH 45215.

'Automotive Applications For Polymers'

"Automotive Applications for Polymers", a new techno-economic multiclient study, has been published and is now available. The 400-page investigation deals exclusively with the consumption of polymeric compositions in current and potential applications in U.S. made cars sold in the U.S. market. Relevant information is provided by 300–400 interviews with industry experts—primarily key personnel in the automobile companies and fabricators; formulators; raw materials suppliers; trade associations, and government agencies. Fee for the study is $7,000. A free brochure, with Tentative Table of Contents, is available from Skeist Laboratories, Inc., 112 Naylon Ave., Livingston, NJ 07039.

'Conductive Polymers And Plastic Compositions'

A comprehensive multi-client study entitled, "Conductive Polymers and Plastic Compositions," is being undertaken by Skeist Laboratories, Inc. The technology and markets for more than 50 conductive compositions will be thoroughly studied. Plastics, coatings, adhesives, elastomers, and conductive polymers such as quaternary polymers, polyacetylenes, and polyphenylenes, poly (sulfur nitride), poly (phthalocyanines), and poly (vinylcarbazole) will be included. Price for early subscription is $5,500. For additional information, contact Skeist Laboratories, Inc., Joseph Rocky or Arnold Brief, 112 Naylon Ave., Livingston, NJ 07039.

Cartridges

Information is available on the new "4" formulation addition to Micro-Klean® II line of cartridges. The addition of the "4" formulation is discussed and its ability to provide increased chemical resistance is explained as are its compatibilities. Its broader filtration capabilities which range from 1 micron to 125 microns are featured. For literature, contact AMF Cuno Industrial Filter Products Div., 400 Research Parkway, Meriden, CT 06450.

Aluminum Pigments

Literature is available introducing two new aluminum pigments for application in a wide variety of maintenance and marine finishes. For information, contact Alcan Ingot & Powders, Elizabeth, NJ 07207.

Coming Events

FEDERATION MEETINGS

1984

(May 17–18)—Spring Meetings. Society Officers on 17th; Board of Directors on 18th. Galt House, Louisville, KY. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(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).

SPECIAL SOCIETY MEETINGS

1984

(Jan. 17–18)—Cleveland Society for Coatings Technology. Joint Manufacturing Committee Symposium with the Cleveland PCA. "Tools for Tomorrow: Increased Profitability Thru Innovative Manufacturing Concepts."

(Feb. 7–9)—"Water-Borne and Higher-Solids Coatings" Symposium sponsored by the Southern Society for Coatings Technology and the University of Southern Mississippi. New Orleans, LA. (Dr. Gordon L. Nelson, Chairman, Department of Polymer Science, University of Southern Mississippi, Hattiesburg, MS 39406).

(Mar. 7–9)—Southern Society for Coatings Technology. Fiftieth Anniversary Meeting. Surfside Hotel, Clearwater, FL. (James E. Geiger, Sun Coatings, Inc., 12295 75th St., N., Largo, FL 33543).

(Apr. 12–14)—Southwestern Paint Convention of Dallas and Houston Societies. Shamrock Hilton Hotel, Houston, TX.

(May 3–5)—Pacific Northwest Society for Coatings Technology Symposium. Park Hilton Hotel, Seattle, WA. (Robert Hogg, Preservative Paint Co., 5410 Airport Way S., Seattle, WA 98108).

(May 15–16)—Cleveland Society for Coatings Technology 27th Annual Technical Conference, "Advances in Coatings Technology." (Richard Eley, Glidden Coatings & Resins Div. SCM Corp., 16651 Sprague Rd., Strongsville, OH 44136).

(May 16–17)-"Coatings Tech Expo '84." 3rd Biennial Convention & Exposition sponsored by New England Society for Coatings Technology. Sheraton Inn & Conference Center, Boxborough, MA. (Chairman Paul J. Muller, D.H. Litter Co., Inc., P.O. Box 247, Ballardvale, MA 01810).

(June 8–9)—Joint Meeting of St. Louis and Kansas City Societies for Coatings Technology. Kansas City, MO.

1985

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

(Apr. 25–27)—Pacific Northwest Society for Coatings Technology Symposium. Empress Hotel, Victoria, B.C. (Ottwin Schmidt, Shanahan's Ltd., 8400 124th St., Surrey, B.C., Canada V3W 6K1).

OTHER ORGANIZATIONS

(Dec. 7–8)—"Painting Public Structures: Practices and Economics" Symposium sponsored by the Steel Structures Painting Council. Cocoa Beach, FL. (Dr. Harold Hower, SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213).

(Dec. 12–14)—"Color Control Technology" Seminar sponsored by Applied Color Systems, Inc. Disneyworld/Epcot Center, FL. (ACS, Inc., P.O. Box 5800, Princeton, NJ 08540).

1984

(Feb. 8–10)—"Appearance Science Workshop." HunterLab, Reston, VA. (Ms. V. Baca, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090).

(Feb. 12–15)—Inter-Society Color Council Conference. Colonial Williamsburg Lodge. Williamsburg, VA. (Fred W. Billmeyer, Dept. of Chemistry, Rensselaer Polytechnic Institute, Troy, NY 12181).

(Feb. 12–16)—14th Australian Polymer Symposium sponsored by the Polymer Div. of the Royal Australian Chemical Institute. Old Ballarat Motor Inn, Ballarat, Australia. (Dr. G.B. Guise, RACI Polymer Div., P.O. Box 224, Belmont, Vic., 3216, Australia).

(Feb. 16–17)—"Frontiers in Color Science" Symposium. Rochester Institute of Technology, Rochester, NY. (Dr. Franc Grum, School of Photographic Arts and Sciences, RIT, P.O. Box 9887, Rochester, NY 14623).

(Mar. 25)—Painting and Decorating Contractors of America Convention and Show. New York Hilton, New York, NY. (Mr. E. Glen Craven, PDCA, 7223 Lee Hwy., Falls Church, VA 22046).

(Apr.)—"Electrochemical Test Methods of the Protecting Properties of Metals Coatings" Meeting. Genoa, Italy, (Prof. P.L. Bonora, Istituto di Chemica, Fac. Ingegneria—Fiera del Mare Pad. D. 16129 Genova, Italy).

(Apr. 4–11)—"Surface Treatment Exhibition" at the 1984 Hannover Fair, Hannover, West Germany. (Hannover Fairs Information Center, P.O. Box 338, Rt. 22 E., Whitehouse, NJ 08888).

(Apr. 8–10)—Inter-Society Color Council Annual Meeting. Michigan Inn, Southfield, MI. (Fred W. Billmeyer, Dept. of Chemistry, Rensselaer Polytechnic Institute, Troy, NY 12181).

(Apr. 12–15)—"FARBE 84". Munich Trade Fair Centre, Munich, West Germany. (Kallman Associates, Five Maple Court, Ridgewood, NJ 07450).

(Apr. 24–25)—Electrocoat/84 Conference, sponsored by *Products Finishing* Magazine. Drawbridge Inn, Cincinnati, OH. (Anne Porter, Products Finishing, 6600 Clough Pike, Cincinnati, OH 45244).

(May 1–4)—Painting and Decorating Contractors of America. 100th Anniversary Meeting. New York, NY.

(May 1–3)—Oil & Colour Chemists' Association's 35th Annual Exhibition. London, England. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, HAO 2SF).

(May 16–18)—"Appearance Science Workshop." HunterLab, Reston, VA. (Ms. V. Baca, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090).

(June 10–13)—"58th Colloid and Surface Science Symposium." Carnegie-Mellon University, Pittsburgh, PA. (G.D. Parfitt, Chemical Engineering Dept., Carnegie-Mellon University, Pittsburgh, PA 15213).

(June 17–20)—Dry Color Manufacturers' Association's Annual Meeting. The Greenbrier, White Sulphur Springs, WV. (P.J. Lehr, DCMA, Suite 202, 206 N. Washington St., Alexandria, VA 22314).

(July 9–13)—10th International Conference on "Organic Coatings Science & Technology." Athens, Greece. (Prof. Angelos V. Patsis, Director, Materials Research Lab., CSB 209, State University of New York, New Paltz, NY 12561).

(Sept.)—"Maintenance Painting of Industrial Plants" Symposium sponsored by the Steel Structures Painting Council. Pittsburgh, PA. (SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213).

(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. Bourgery, Secretary General, FATIPEC, Maison de la Chimie, 28 Rue St.-Dominque, 75 Paris (7), France).

(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).

(Nov. 16–18)—37th National Decorating Products Show. McCormick Place, Chicago, IL. (NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132).

(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

(June 26–29)—Oil & Colour Chemists' Association's Biennial Conference. Edinburgh, Scotland. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, HAO 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).

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I certify that the statements made by me above are correct and complete. (signed) Robert F. Ziegler, Editor.

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'Humbug' from Hillman

Lewis K. Hosfeld, one of our loyal "Humbug" contributors, recently sent us one of his articles written for his local Lancaster, PA newspaper. Lew had kindly permitted us to excerpt portions for "Humbug." Personally, I still bridle every time temperatures are given in "Celsius" instead of that good, old fashioned "Centigrade."

The Mile—The Meter?

As everyone probably knows, a few years ago the federal government passed legislation recommending that the metric system be adopted as soon as possible. For length measurements, we should use millimeter, centimeter, meter and kilometer instead of inch, foot, yard and mile. Then after the government estimated what it would cost to replace all the mileage signs to metric measurements, it decided it couldn't afford it.

I'm sort of glad they decided to keep the mile. Even with the new speedometers reading miles per hour and kilometers per hour, I think most of us feel more comfortable traveling miles instead of kilometers.

In case you've forgotten, the inch measurement was decided in the time of King Edward II, and it was the length of three barleycorns laid end to end. Also, it was about the length of your thumb knuckle, and also the length of your forefinger from the tip to the first joint. Now that's something you can readily visualize!

Shoe sizes today still are based on the three barleycorns per inch principle. It was determined that the longest foot was 13 inches, so this length was designated size 13. So 12⅔ inch became size 12, 12⅓ became size 11, etc. I can't think of a better way of measuring shoe sizes than by grains of barley! There's certainly a bit of nostalgia in all these traditional measurements. In Old England, the acre was the area of land a man and a yoke of oxen could plow in one day.

The foot goes back to the Romans, and was originally the length of a man's foot, without shoes, of course. The yard was set as the distance from the nose of the English King Edgar to the tip of his unstretched middle finger. For some anatomical reason, this equaled three feet.

The mile was supposed to be the distance that a Roman legion could march in a 1000-pace count. A soldier's pace (distance when one foot leaves the ground until the same foot touches the ground again) was about five feet, so the mile was originally around 5000 feet.

The length of a furlong (or furrowlong) was established by early Tudor rules as 220 yards. This led Queen Elizabeth I to declare, in the 16th Century that henceforth the traditional Roman mile of 5,000 feet would be replaced by one of 5,280 feet, so that the mile would equal exactly eight furlongs. Thus, a convenient relationship between two previously ill-related measures was established.

It was the French who suggested that units of measurement should be based on a fraction of the circumference of the earth. Now that we are used to space travel, this concept doesn't seem so great after all, but at that time, it was considered a giant step forward — using the earth instead of fingers, arms, feet, etc. to establish a basic unit of measure. In 1790, a new standard of length, equal to one ten-millionth of the distance from the North Pole to the equator along a meridian running through Paris, was designated as the meter. One hundredth of this unit was, of course, the centimeter, and a thousand of these became the kilometer, since the new system was based on powers of 10's. By the 1900's, 35 nations had officially accepted the metric system.

The exact reference standards for the meter not very long ago were metal bars, made from blends of platinum and iridium. Then in 1960, it was decided that these metal bars were not accurate enough. It was found that krypton, a rare gas that occurs at a concentration of only one part per million in air, when excited in a tube, like a neon light, produced very sharp orange red spectral lines. So a meter became 1,650,763.73 times the wave length (in vacuum) of krypton 86 radiation.

The new proposal which probably will be adopted in October 1983 in Paris will do away with the krypton meter and replace it with a time standard. The speed of light will have a fixed value of 299,792,458 meters per second. The meter will be defined as the length of a path traveled by light in a vacuum during a time interval of 1/299,792,458 of a second.

In the scientific world, such accuracy is needed, but in our normal parlance, I think it's nice to keep the inch — foot — yard and mile. I'm glad the federal government decided not to change all the mileage signs to kilometers. So, when you're on vacation, and someone asks where Lancaster is, it's still OK to say "65 miles West of Philadelphia."

• • •

Noah Way

And the Lord said unto Noah: "Where is the ark which I have commanded thee to build?"

And Noah said unto the Lord: "Verily, I have had three carpenters off ill. The gopher-wood supplier hath let me down—yea, even though the gopher wood had been on order for nigh upon 12 months. What can I do, O Lord?"

And God said unto Noah: "I want that ark finished even after seven days and seven nights."

And Noah said: "It will be so."

And it was not so. And the Lord said unto Noah: "What seemeth to be the trouble this time?"

And Noah said unto the Lord: "Mine subcontractor hath gone bankrupt. The pitch which Thou commandest me to put on the outside and on the inside of the ark hath not arrived. The plumber hath gone on strike. Shem, my son who helpeth me on the ark side of the business, hath formed a pop group with his brothers Ham and Japheth. Lord, I am undone."

And the Lord grew angry and said: "And what about the animals, the male and the female of every sort that I ordered to come unto thee to keep their seed alive upon the face of the earth?"

And Noah said: "They have been delivered unto the wrong address but should arriveth on Friday."

And the Lord said: "How about the unicorns, and the fowls of the air by sevens?"

And Noah wrung his hands and wept, saying: "Lord, unicorns are a discontinued line; thou canst not get them for love nor money. And fowls of the air are sold only in half-dozens. Lord, Lord, Thou knowest how it is."

And the Lord in His wisdom said: "Noah, my son, I knowest. Why else dost thou think I have caused a flood to descend upon the earth?"

Journal of Eastern Region of the
Royal Institute of British Architects

All those who would like to contribute to "Humbug" are urged to correspond with me at Humbug's Nest, Box 135, Whitingham, VT 05361.

—Herb Hillman

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