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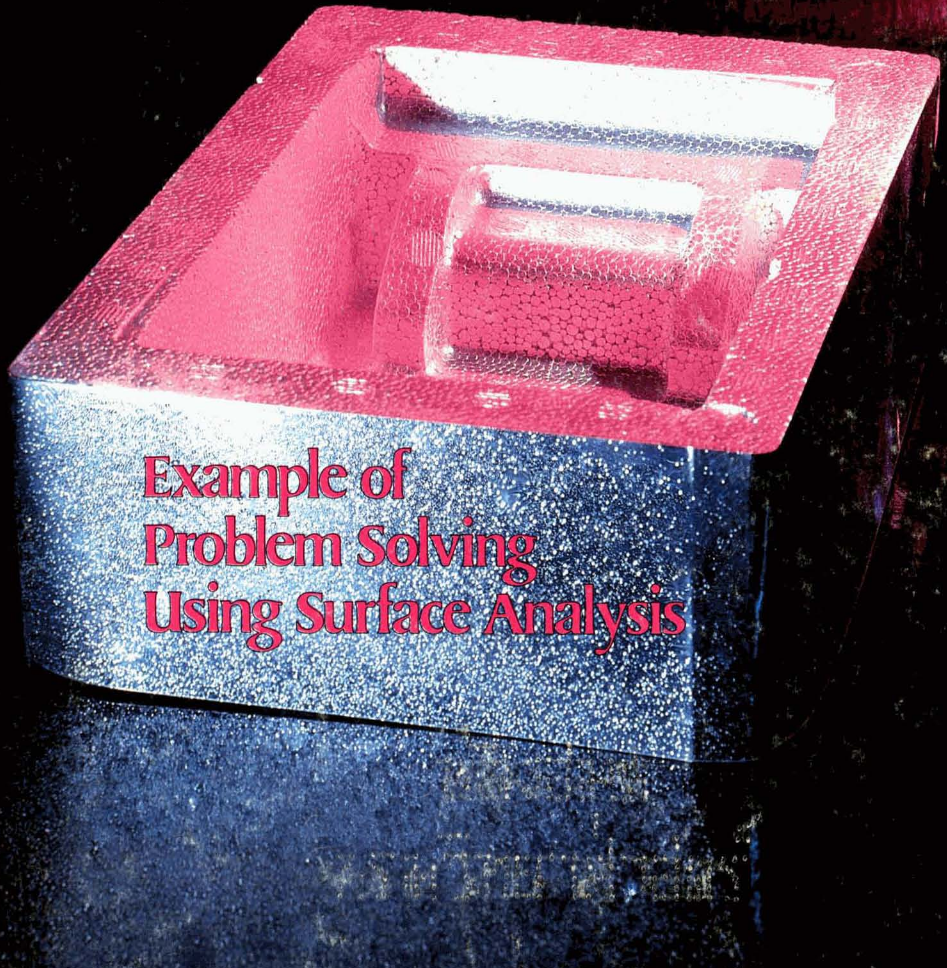
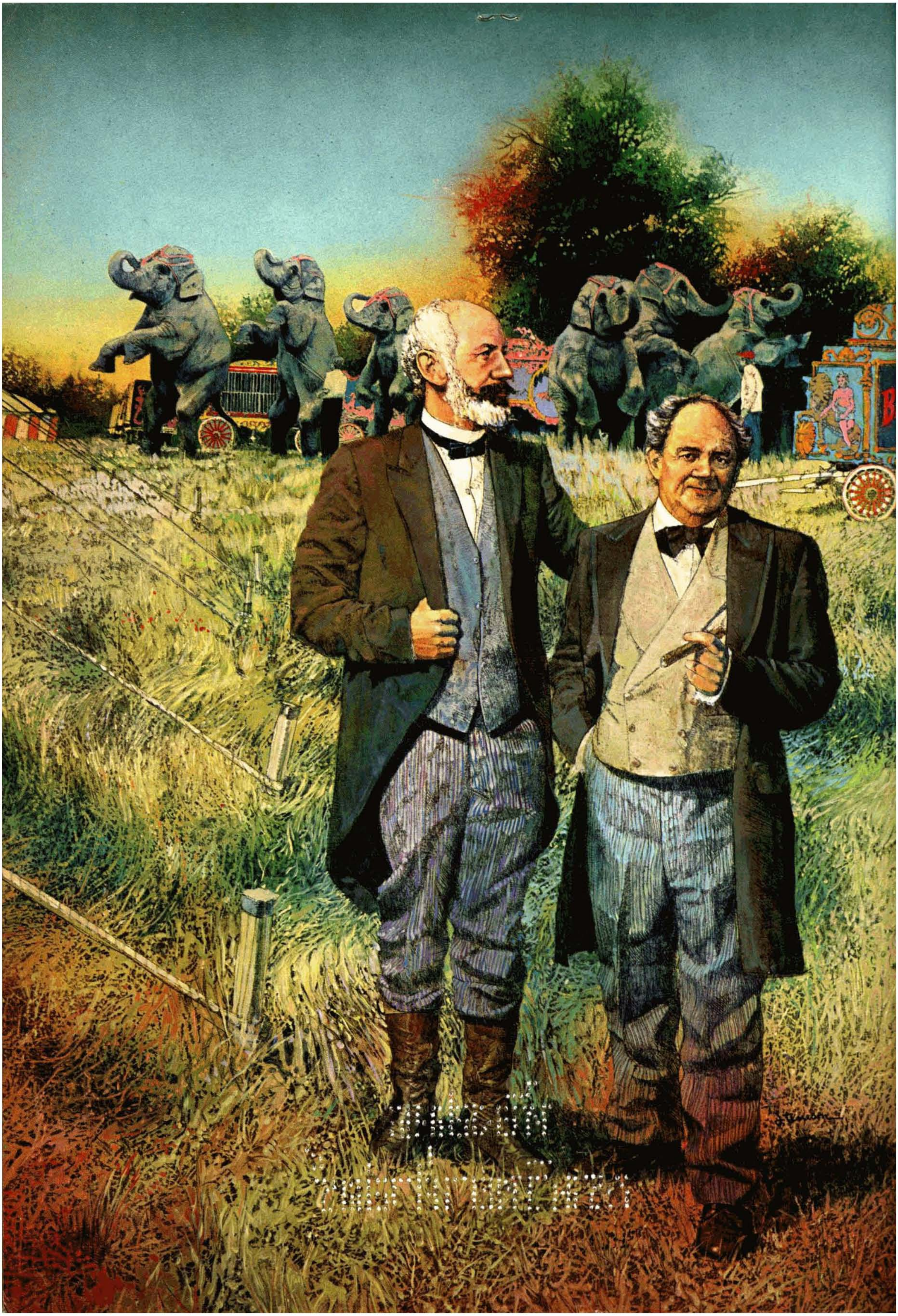
MAY 1983

jct JOURNAL OF COATINGS TECHNOLOGY

FSCT
61st Annual Meeting
48th
Paint Industries' Show
MONTREAL
October 12-14, 1983



Example of Problem Solving Using Surface Analysis



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VOLUME 55 NUMBER 700

Technical Articles

Federation News

Departments

BPA Membership Applied for May 1982

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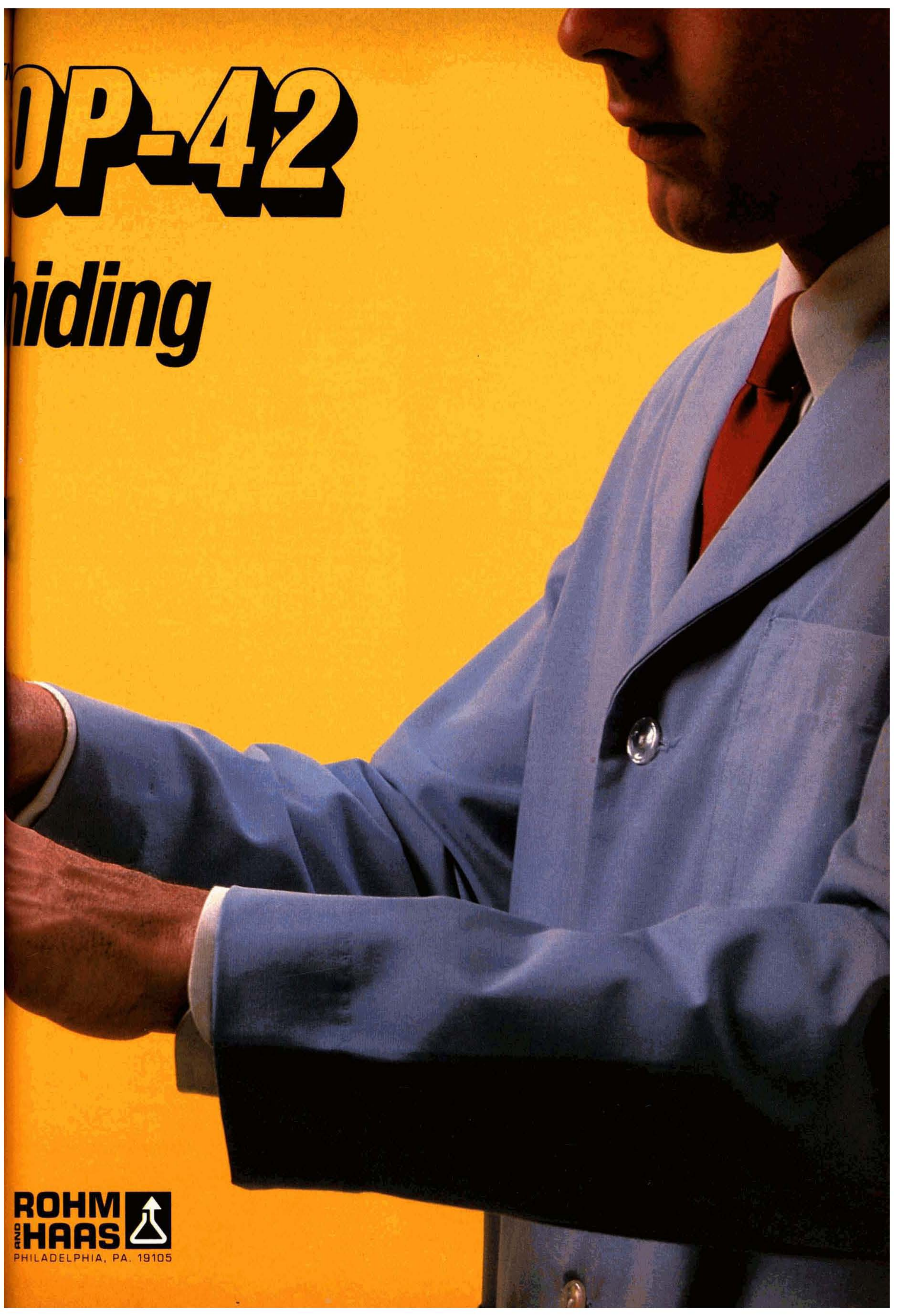
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Comment

Communication = Common Action

Over the past several months this space has been devoted to the discussion of topics touching on the professional life of the Federation member. All of these items signal the one point necessary in any successful organization—Communication.

In the Federation, communication is beyond being a necessity; it is the *raison d'etre,* and the JCT is the backbone of this communication link.

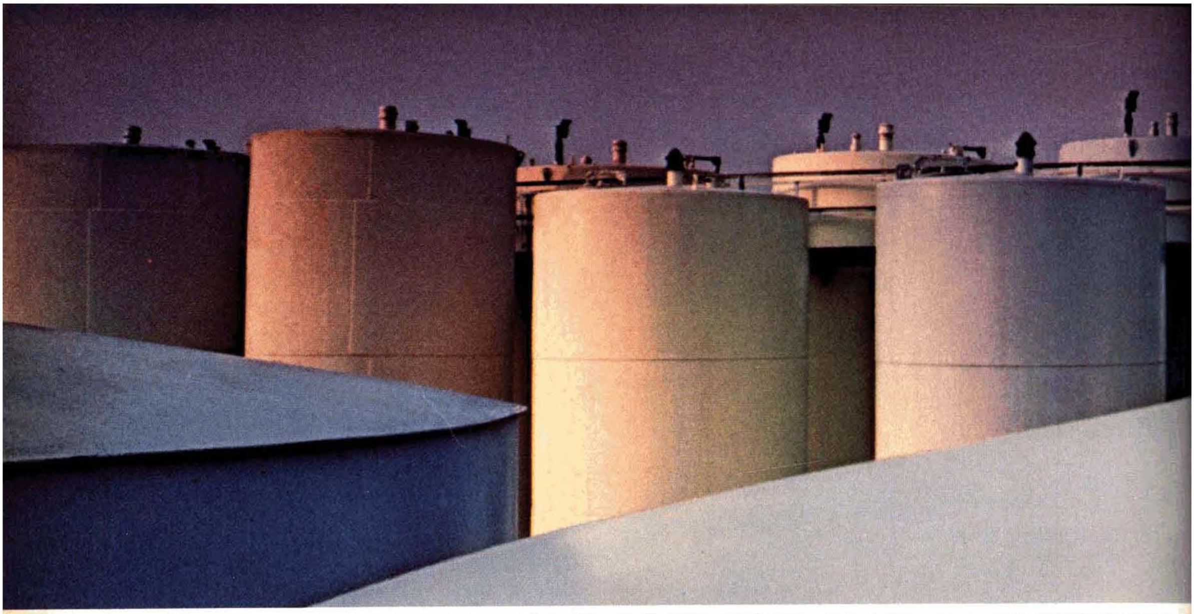
Reaching out monthly, the JCT informs the Federation's 6,800 members of what is happening at the national level and at the local level through news of its 26 Constituent Societies. News of the Federation and its members also goes to the 3,000 non-member subscribers, thus presenting an information network between the reader and the world coatings industry.

In the recent past, the JCT has seeked to improve this forum by instituting several new features. The Federation News section focuses on the developments within the FSCT and features items on upcoming events, such as the announcement of the 1983 Mattiello lecturer, Fred Daniel, in this month's issue. As detailed here last July, the "Open Forum" column is indeed open to everyone and has been used by several readers as a medium to communicate their thoughts and insights to the coatings family-at-large. And, as anyone who has seen the last page of this publication can attest, Herb Hillman's "Humbug" column effectively strips away the serious facade of industry to reveal the humour and humanity which exist.

The JCT is a technical journal and an association magazine, but most of all it is the connection between you and your neighbor in the coatings community.

Robert F. Ziegler

Robert F. Ziegler,
Editor



CIBA-GEIGY epoxy resins vs. the toughest applications around

Aggressive chemicals and organic solvents are tough on storage tank linings. Formulating a coating that resists them is not an easy job if you don't have the right components. Now, three new products from CIBA-GEIGY can help you change that.

Coatings based on XU-252.

Our new high performance novolac epoxy resin can take on many aggressive chemicals—including chlorinated solvents, ethanol, methanol, aromatic amines, acids, caustic and ammonia—under a variety of service temperatures.

XU-252 based coating.

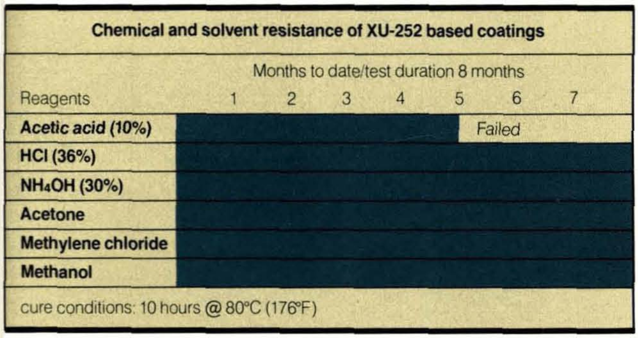
Chemical exposure cell proves outstanding performance.

One of the most realistic tests for chemical resistance, the chemical exposure cell, is designed to simulate service conditions as closely as possible. A coated panel is attached to the end of a cylinder so that the chemical being tested makes direct contact with only the coated surface.

As you can see in the panels, an XU-252 based coating showed no sign of failure even against a solvent like methylene chloride, while one formulated with a standard bisphenol-A based epoxy resin softened and blistered.

Bisphenol-A based coating.

We also tested XU-252 based coatings for resistance against a range of other chemicals. The chart shows some of the toughest ones. In all cases these coatings exhibited excellent resistance to continuous exposure for a minimum of eight months.



Chemical and solvent resistance of XU-252 based coatings

Reagents	Months to date/test duration 8 months 1	2	3	4	5	6	7
Acetic acid (10%)	■	■	■	■	■	Failed	
HCl (36%)	■	■	■	■	■	■	■
NH_4OH (30%)	■	■	■	■	■	■	■
Acetone	■	■	■	■	■	■	■
Methylene chloride	■	■	■	■	■	■	■
Methanol	■	■	■	■	■	■	■

cure conditions: 10 hours @ 80°C (176°F)

Two new hardeners increase chemical resistance.

HY-943 and HY-2969 when formulated with XU-252 provide a variety of new properties.

HY-943 produces solvent-free and high solid coatings with excellent alcohol and chlorinated solvent resistance.

HY-2969 produces solvent-free systems resistant to acids and aromatic solvents even as tough as benzene.

Tell us about your toughest applications.

Storage tank linings are only one of the tough applications CIBA-GEIGY epoxy resins and hardeners can handle. They're also ideal for such applications as pickling lines, hot waste disposal and nuclear containment areas, pollution control equipment, and flooring in pulp and paper mills.

If you have a tough application that demands a durable, long lasting coating, tell us about it and we'll tell you how our epoxy resins and hardeners can help you formulate one. Write CIBA-GEIGY Corporation, Resins Department, 3 Skyline Drive, Hawthorne, New York 10532, or call 800-431-1900. In New York 914-347-4700.

CIBA–GEIGY

ACRYLIC BREAKTHROUGH

DO THE ROOFING

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

INDUSTRY A BIG ACRYLIC FAVOR

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

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

Offer Roof Mastics Based on New RHOPLEX™ EC Technology

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

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

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

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

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

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

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

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Abstracts of Papers in This Issue

EXAMPLE OF PROBLEM SOLVING USING SURFACE ANALYSIS—S.J. Valenty

Journal of Coatings Technology, 55, No. 700, 29 (May 1983)

The use of surface analytical instrumentation resulted in the solution of a plastics molding problem. By looking for differences between "good" and "bad" areas on the surfaces of a finely textured aluminum molding tool and a matching polymethylmethacrylate (PMMA) part, optical microscopy, scanning electron microscopy/energy dispersive X-ray analysis, Auger, and ESCA were able to show that a sulfur containing organic material was adhering to the tool. This film obscured fine mold detail and led to sticking. Gas chromatography, mass spectrometry, and X-ray fluorescence analysis determined the source of the sulfur to be one or more relatively volatile, low molecular weight compounds found in some PMMA formulations. After bonding a protective silicone coating to the surface of an unused aluminum tool, the PMMA parts separated cleanly without leaving a permanent residue. The thickness of the coating as measured by secondary ion mass spectrometry was 300–500 Å. This laboratory demonstration was successfully transitioned to the factory floor.

COLLOID CHEMISTRY OF WATER-REDUCIBLE COATINGS. PART I: VISCOSITY BEHAVIOR—J.R. Overton and C.A. Herb

Journal of Coatings Technology, 55, No. 700, 33 (May 1983)

The viscosity behavior was determined of an amine-neutralized polyester resin dissolved in ethoxyethanol when diluted with water. Typically complex viscosity dilution behavior was observed. Reasoning from dilute solution viscosity behavior, the concentration dependence of viscosity at constant water content, the viscosity shear rate dependence, and data on sedimentation by means of ultracentrifugation, a molecular interpretation of this phenomenon is offered. The data are explained in terms of conventional intermolecular segmental interactions at low water contents and aggregate formation at higher water contents.

HIGH SOLIDS COATINGS FROM NEW OLIGOMERS—M.S. Chattha and J.C. Cassatta

Journal of Coatings Technology, 55, No. 700, 39 (May 1983)

A tetrahydroxy oligomer was prepared by reacting the reaction product of 2-ethyl-1,3-hexanediol and methylhexahydrophthalic anhydride with 1,4-butanedioldiglycidyl ether. This oligomer was crosslinked with hexamethoxy melamine to obtain coatings containing 350 to 400 g/L (2.9 to 3.4 lb/gal) volatile organic compounds (VOC) with excellent physical properties. The accelerated weathering performance of these coatings is comparable to that of high solids acrylic-melamine coatings.

In order to further increase the solids content of high solids coatings, a new difunctional oligomer was synthesized by the reaction of one mole of methylhexahydrophthalic anhydride with two moles of 2-ethyl-1,3-hexanediol. Incorporation of this oligomer to the above paint composition has provided coatings containing 320-400 g/L (2.7 to 3.4 lb/gal) VOC.

OXAZOLIDONE COATINGS. PART I: SYNTHESIS AND STRUCTURE—P.I. Kordomenos, K.C. Frisch, and J.E. Kresta

Journal of Coatings Technology, 55, No. 700, 49 (May 1983)

The catalysis of the oxazolidone-forming reaction was studied using isocyanate and epoxy functional model compounds employing different catalyst systems. It was found that the concentration of the NCO group decreased during the reaction faster than the concentration of the epoxy group. Several side reactions were investigated in order to explain this phenomenon. Oxazolidone ring-containing polymers such as polyoxazolidones, poly(oxazolidone-isocyanurates), poly(oxazolidone-epoxides), and poly(oxazolidone-urethane-isocyanurates) were prepared and characterized.

OXAZOLIDONE COATINGS. PART II: STRUCTURE-PROPERTIES RELATIONSHIPS AND THERMAL STABILITY—P.I. Kordomenos, K.C. Frisch, and J.E. Kresta

Journal of Coatings Technology, 55, No. 700, 59 (May 1983)

The structure-properties relationships of oxazolidone ring-containing polymers including polyoxazolidones, poly(oxazolidone-isocyanurates), poly(oxazolidone-epoxides), and poly(oxazolidone-urethane-isocyanurates) were investigated. It was found that the thermal stability of these polymers, as determined by TGA, increased with increasing concentration of the oxazolidone rings and increasing crosslink density. The hardness, stress-strain properties, and solvent resistance of the oxazolidone-containing polymers without the urethane linkages were very good, while the Gardner impact resistance was only moderate to low. The introduction of urethane linkages in these polymers significantly improved the impact resistance but somewhat decreased the thermal stability depending upon the chain length of the polyether diol used.

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Frederick K. Daniel to Present Mattiello Lecture At 1983 Federation Annual Meeting in Montreal

The Federation of Societies for Coatings Technology is pleased to announce that Frederick K. Daniel, founder of Daniel Products Co. and noted authority in the field of dispersion technology, will present the 1983 Joseph J. Mattiello Memorial Lecture at the 61st Annual Meeting of the Federation, to be held October 12–14 at Place Bonaventure, Montreal, Quebec, Canada.

Mr. Daniel will speak on "The Obstacle Course from Mill Base to Finished Coating," at the morning session on Friday, October 14.

Early Career

A native of Hamburg, Germany, Mr. Daniel graduated from high school in 1930. He initially studied aircraft engineering at the Technological Institute of Berlin, but later switched to chemistry and subsequently enrolled at the University of Hamburg. This was a period of extreme political unrest, and a year after enrolling at Hamburg, his studies were interrupted when the Nazi party came to power. In August 1933, he transferred to the University of Zurich, Switzerland, and there became interested in colloid chemistry.

In 1934, new currency regulations went into effect which cut off his support from home, and made completion of the regular chemistry curriculum impossible. He decided to break off his studies in Zurich and instead go to London to do research for one year under Professor H. Freundlich, the foremost colloid chemist of his time.

His work on natural rubber latex soon resulted in two patents, which Professor Freundlich was able to sell for him. With that money, he was able to extend his research for another year, until the end of 1936, when he and his wife, Ruth, came to the United States.

By a rare piece of luck, he was immediately offered the opportunity to set up a New Products Development subsidiary of the A. C. Horn Co., paint manufacturers in Long Island City, NY. This became a highly successful undertaking, leading to the development of an odd assembly of products and processes. The focus of all these developments was the utilization of by-products and waste products from other industries.

Coatings Research

Among the most successful products was a sulfolignin dispersing agent for aqueous systems; this was produced by a fully automated dialysis process, from sulphite liquor, a waste product of paper manufacture. Other successful products were aqueous carbon black dispersions and air-entraining agents for use in concrete highways, and mud-drilling compounds for use in oil drilling operations. Mr. Daniel also developed, and sold, patents for purifying biological fluids by novel ion exchange methods, and for eliminating salt from milk and whey for medicinal purposes. After 10 years, in 1946, these freewheeling activities ended when the Sun Chemical Co. bought the A. C. Horn Co., along with the subsidiary in which Mr. Daniel had a minority financial interest. Sun was not interested in continuing these diverse pursuits in areas unrelated to their core business, and so Mr. Daniel decided to become a consultant.

His first major consulting project was to teach paint manufacturers how to produce more or better paints in a shorter time by means of the so-called Flow Point Method, which he had developed in the 1940's but had not yet introduced to the coatings industry. The Scientific Section of the Paint, Varnish and Lacquer Association (now National Paint and Coatings Association) deemed the results of this new technique sufficiently important to bend their established policy of publishing only scientific contributions from their own staff. Mr. Daniel was invited to submit the Flow Point Method for publication in the Scientific Section Circular. It appeared in October 1950 (#744) under the title, "A System for Determining the Optimum Composition of Paints in Ball and Pebble Mills." Since then, he has become known as the Flow Point Daniel.

A few years later, in 1953, he became associated with the D. H. Litter Co., a New York manufacturer's representative for the coatings and allied industries. Together they formed the Daniel-Litter Laboratories (now D/L Laboratories), doing consulting work mostly for raw material manufacturers. In 1955, Mr. Daniel perceived the need for specialized pigment dispersions and chemical additives for the coatings industry and decided to form a company for the manufacture of such products. The success of that venture, Daniel Products Co., confirms the validity of his original concept.

Five years ago, he sold his company to Synres Chemical Co., a Dutch-based resin manufacturer which, in turn, is a subsidiary of the State-owned Dutch DSM organization. He stayed on until recently as President and a Director of Daniel Products Co. Currently he is active on a part-time basis as a Consultant. He is also working on a monograph for the Federation Series on Coatings Technology.

Author and Lecturer

Mr. Daniel has more than a dozen patents to his name and has authored more than 30 papers, most of them dealing with colloidal and rheological aspects of coatings technology. He has lectured widely in the U.S., Canada, and Europe. In 1964 he delivered the official U. S. Plenary Lecture at the FATIPEC Congress in Vichy, France. His paper, "Flocculation and Related Pigment Interactions in Paints," pointed out the quantitative aspects of flocculation and called attention to the benefits of coflocculation, a hitherto overlooked but important phenomenon.

He has been a member and chairman of numerous technical subcommittees of the New York Society for Coatings Technology and is the recipient of the Society's prestigious Roy H. Kienle and PaVaC Awards. He is also the recipient of Morehouse Industries, Inc.'s Golden Impeller Award, for outstanding contributions to dispersion technology.

Mr. Daniel is a former Chairman of the Federation Liaison Committee, and continues to serve as a member of that committee.

Chrome Chemicals: Helping to Preserve America's Resources

Solar energy is an important part of America's plan to conserve its precious fuel reserves. And Allied Chemical chrome chemicals are playing a key role by helping to improve the heat collection efficiency of the latest solar collection panels. Coating copper collection panels with black chrome made from Allied Chemical chromic acid produces a deep-black matte finish that significantly increases absorption of the sun's rays.

But chrome chemicals protect more than our valuable energy resources. Chromium sulfate is the *essential ingredient in the tanning* agents used to preserve America's shoes and leatherware. And chrome plating is one of the most efficient methods of protecting metals and engine parts from corrosion and wear.

In application after application, chrome chemicals are helping to improve the *quality* of our lives. For example, they are used as a fixing agent for use in the preservation of wood, in the creation of dyes and pigments and in the manufacture of magnetic particles for video recording tapes.

So don't just think of chrome chemicals as attractive luxuries used only for fancy coatings and shiny finishes. They're a vital necessity and an essential part of the American way of life.

For the full story on chrome chemicals' unique contribution, *write: Manager—Chrome Chemicals,* Allied Chemical, P.O. Box 1053R, Morristown, New Jersey 07960.

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The operation provides standard grades as well as grades for special applications. For example, extensive marketing and technical experience has created special grades for the paint industry. Each offers its own unique, consistent characteristics providing you maximum flexibility and control of your paint product.

So whether your market is industrial or consumer, if you need consistent quality and uniform gloss/sheen control, it's in the bag . . . the Manville Celite bag.

For additional information on suggested grades of Celite filler and usage ratios, or our complete line of filter cartridges, call your Manville sales representative or write: Manville, Filtration and Minerals, P.O. Box 5108, Denver, CO 80217. (303) 978-2656.

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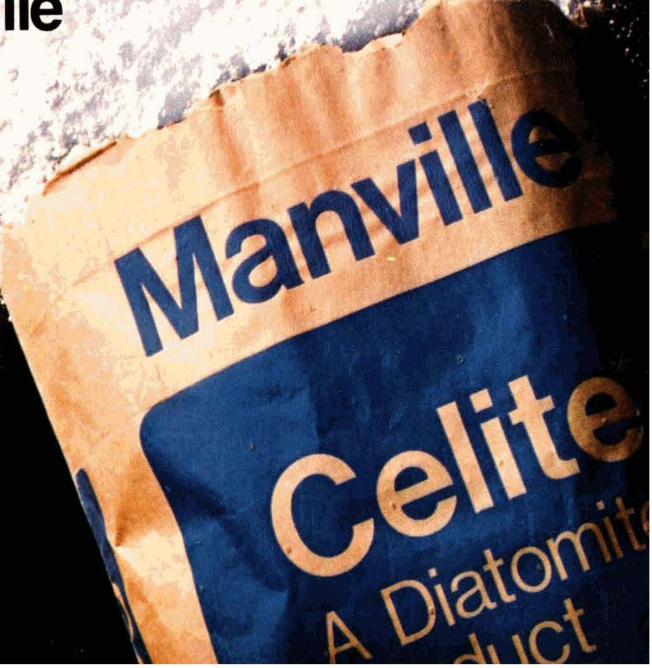
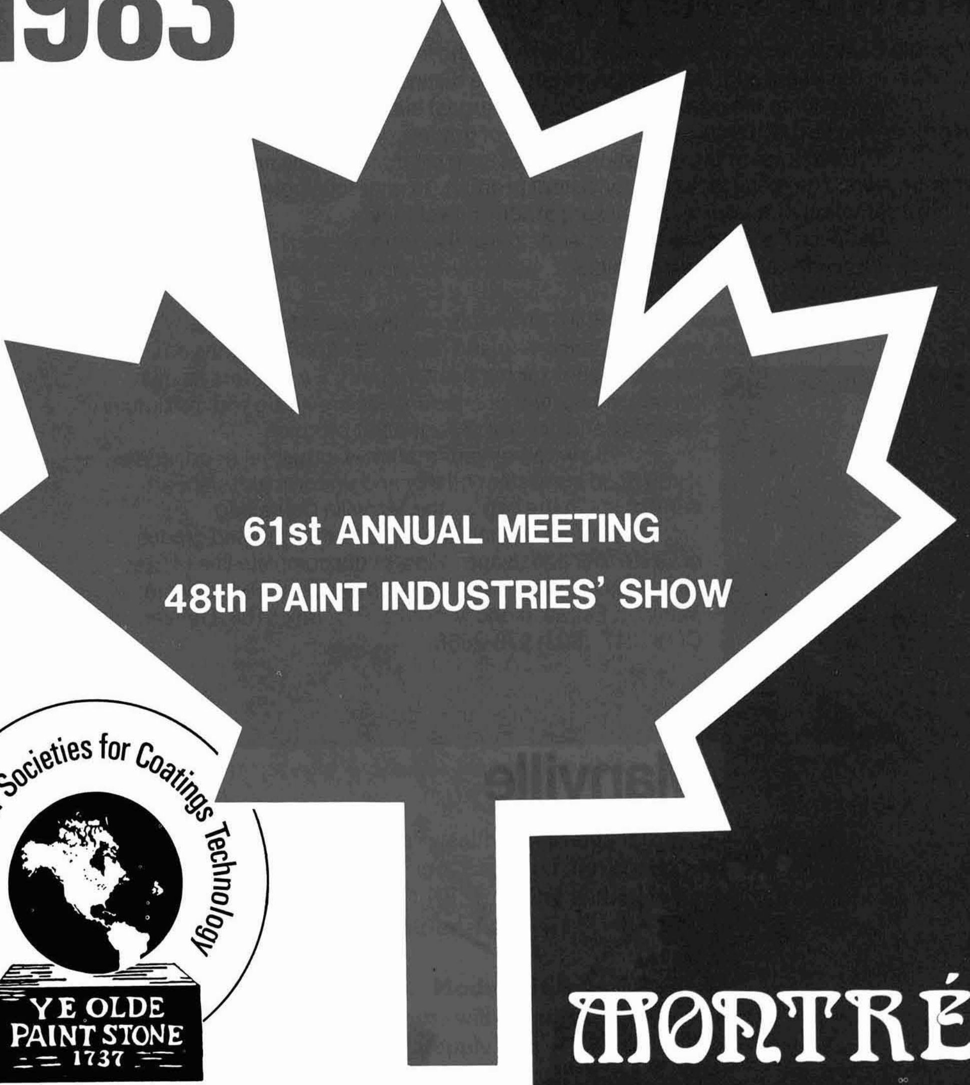


Federation of Societies for Coatings Technolog

1983



61st ANNUAL MEETING

48th PAINT INDUSTRIES' SHOW

Federation of Societies for Coatings Technology

YE OLDE PAINT STONE 1737

MONTRÉAL

Place Bonaventure

October 12, 13, 14

1983 Annual Meeting
Paint Industries' Show
October 12, 13, 14
Place Bonaventure
Montreal, Quebec, Canada

AC Boyce

A. Clarke Boyce
President
Federation of Societies
for Coatings Technology

TO OUR MEMBERS AND FRIENDS:

As the fifth Canadian President of the Federation, it is a distinct pleasure and privilege for me to invite you to the first Annual Meeting and Paint Industries' Show to be held in my native country.

The two host Societies—Montreal and Toronto—are eagerly awaiting this event and have been very busy in making arrangements so that you will have an enjoyable and memorable visit to the beautiful city of Montreal.

The Paint Show, which we expect will be the biggest ever, will be held in one of Canada's top showplaces, Place Bonaventure. This magnificent building, truly a city within a city, sits on top of another city within a city—Place Ville Marie.

Program sessions will be geared to the theme of the meeting, "Knowledge Applied Profitably." The selection of papers, workshops, and seminars being arranged by Peter Hiscocks and his Program Committee will send you home with a pocketful of ideas to put to profitable use in your companies.

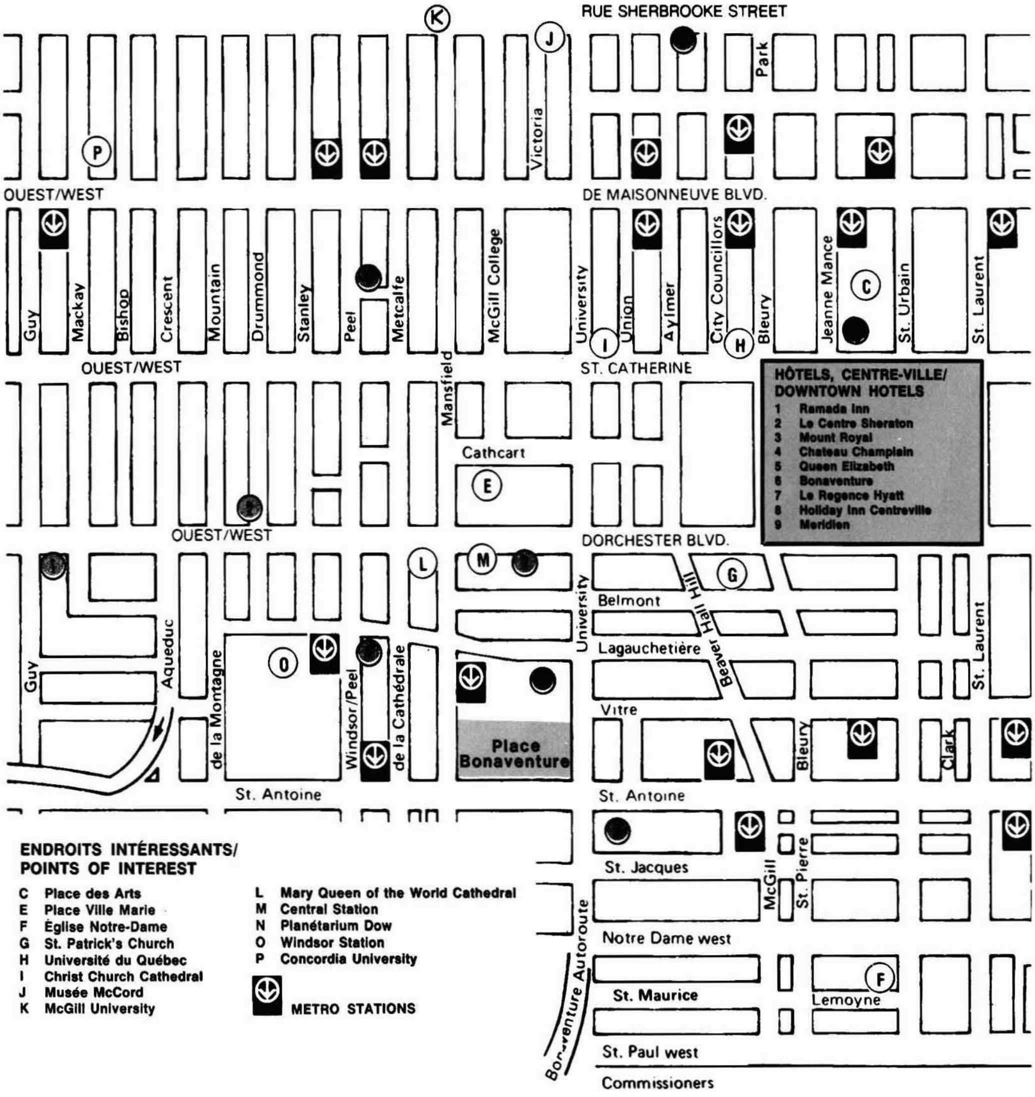
On behalf of the 800 Canadian members associated with the Montreal, Toronto, Detroit, Northwestern, and Pacific Northwest Societies . . . Bienvenue a Canada.

HOTEL INFORMATION AND RATES

All Rates are in Canadian Funds

Hotel	Singles	Doubles Twins	Parlor & 1 Bedroom	Parlor & 2 Bedrooms	Parlor & 3 Bedrooms
QUEEN ELIZABETH*	$79	$89	$208/220/246 271/280	$376/382/305 420	$544/635
HOTEL BONAVENTURE*	$95	$105	$250/400	$475	$525
L'HOTEL CENTRE SHERATON	$83	$96	$200/426	$430	
REGENCE HYATT MONTREAL	$83	$95	$164/220/330 480/600	$184/220/330 480/600	
CHATEAU CHAMPLAIN	$84	$96	$210/275	$375	
HOTEL MERIDIEN MONTREAL	$78	$88			
RAMADA INN	$59	$69			
HOLIDAY INN DOWNTOWN	$68	$74	$105		
MT. ROYAL	$53	$63			

*Requests for accommodations at either the Queen Elizabeth or the Bonaventure will be limited to five rooms per company. A parlor counts as one room.



FSCT 1983 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
PLACE BONAVENTURE, MONTREAL, QUEBEC, CANADA
OCTOBER 12, 13, 14 (Wednesday, Thursday, Friday)

APPLICATION FOR HOTEL ACCOMMODATIONS

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

All reservations will be processed by the Montreal Convention and Visitors Bureau.

Please indicate below the type of accommodations desired and choice of hotels. Assignments will be made in accordance with prevailing availability. Three to four weeks after mailing this application you will receive a confirmation from the hotel to which you have been assigned.

To make any inquiries regarding hotel reservations, please observe the following procedure:

Prior to Receiving a Confirmation: Phone the Housing Supervisor of the Montreal Convention and Visitors Bureau. (514-871-1129).

After Receiving a Confirmation: Phone the Reservations Dept. of the hotel. (Phone numbers are given in this brochure).

All reservations will be held until 6:00 p.m. and none can be guaranteed after September 12.

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

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

NAMES AND ADDRESSES OF ROOM OCCUPANTS AND DATES OF ARRIVAL/DEPARTURE

Type of Room	Name	Address	Dates Arrive	Depart

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

SEND CONFIRMATION FOR ALL RESERVATIONS TO:

Name ____________________

Company ____________________

Address ____________________

City ____________________ State or Province ____________________

Country ____________________ Mailing Code ____________________

Note: Requests for accommodations at either the Queen Elizabeth or the Bonaventure will be limited to five rooms per company. A parlor counts as one room.

MONTRÉAL

THE CITY

There's no place like Montreal. Here you'll discover a blend of the best of French and English, of European and North American ways. Montreal is the second largest French-speaking city in the world, and wholly cosmopolitan.

The old and new co-exists comfortably in Montreal, and for all its respect for tradition, this is one of the world's best planned cities. Montreal is a major international business center, a major university center, and the largest inland port in the world. And, it is also a city of arts, home to La Place des Arts, one of the world's best-known entertainment centers.

The "City Below" is Montreal's answer to downtown congestion. Instead of building skyscrapers in the air and chaos on the ground, Montreal put into action an idea first suggested more than 500 years ago by Leonardo da Vinci—a multilevel city which separates people from traffic so that both can move freely: cars and trains through separate tunnels and free-ways, pedestrians through their own enclosed, air-conditioned streets.

The City Below stretches eight miles beneath the avenues of Montreal. Brief, silent (rubber-tires) Metro rides lead to boutiques, department stores, hotels, restaurants, theatres, art galleries and more.

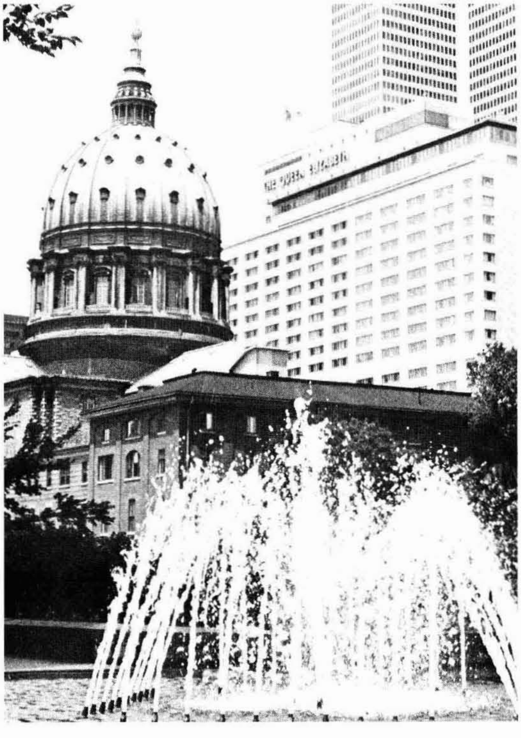
OLD MONTREAL

People frequently portray Montreal as "a little bit of Europe in North America." This description is particularly applicable to that part of the city known as "Old Montreal," the site of the early colonization of the region. The first permanent settlement of Montreal was established by the French explorer, De Maisonneuve in 1642. The early history of French Canada is preserved through the existence of many of the original structures, as well as statues and plaques commemorating the exploits of early explorers, settlers, and military figures.

A stroll through Old Montreal is a treat for even the most casual observer. Some of the oldest and most beautiful architecture in North America is to be found in this quarter.

WEATHER

During the month of October, Montreal's climate ranges from a low of 46° to a high of 57°. Medium to heavy-weight apparel will keep you comfortable. Autumn draws out the best in Mother Nature. Bring your camera to capture the "gold rush" in thick autumn foliage.



Place Bonaventure

AIR TRANSPORTATION

Two major airports serve the city: Dorval, located 16 km (10 miles) from downtown, which handles flights to and from all points in Canada and the U.S.; Mirabel, some 55 km (35 miles) from downtown, for international passenger traffic.

THINGS TO DO

Montreal's 5,000 restaurants, of which more than 100 are internationally rated, serve dishes and specialties from all corners of the earth, making Montreal a gourmet's paradise.

Exquisite French cuisine, wholesome French Canadian dishes and quick snacks are readily available throughout the city, providing quality, variety and convenience.

Vegetarians and health food enthusiasts will find that Montreal leads the way in the preparation and service of specialty foods. Kosher and seafoods also number among Montreal's specialties. The city's culinary shops and delicatessens offer meats, cheeses and other specialties from all over the world.

Montreal has justly earned its reputation as a "city of the world," where life is "a la Quebecoise," at an American pace, with a touch of European charm. It is stimulating, exciting and truly cosmopolitan.

GETTING THERE

If you are a citizen or permanent resident of the U.S., you can cross the Canadian border and return without any difficulty or delay. Passports or visas are not required. Native-born U.S. citizens should carry identification papers such as a birth, baptismal or voter's certificate, and proof of residence. Naturalized U.S. citizens should carry a naturalization certificate or other evidence of citizenship.

After 48 hours in Canada, U.S. residents may take home, duty free, $300 worth of goods for personal and household use. These must accompany the traveler. Family members traveling together may combine their personal exemptions.

PLACE BONAVENTURE

Place Bonaventure is a city within a city. It's a trade city: marketplace of the world's buyers and sellers, showplace for the merchandise of many nations and a rich source of information on trade and tourism.

It covers a six-acre multilevel site, containing not only the Exhibition Hall, where Paint Show exhibits will be on display, but a busy, bustling, boutique-filled Shopping Concourse, complete with stores, bars, restaurants, movies, entertainment, activities and services. And, atop the Place Bonaventure complex, is Hotel Bonaventure with its rooftop gardens.

1983 ADVANCE REGISTRATION

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

1315 Walnut St., Philadelphia, PA 19107

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

Please fill out this form and mail with a check in the correct amount (made payable to the FSCT) to the Federation address shown above. All checks must be payable in U.S. Funds, and in U.S. Banks. Any that are not will be returned. Deadline date for advance registration is September 9. None will be accepted after that date.

INDUSTRY REGISTRATION FEES:

A ☐ **MEMBER** **$50.00**

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

____
Society

B ☐ **NON-MEMBER** **$65.00**

G ☐ **SPECIAL FEE FOR RETIRED MEMBERS** **$25.00**

____
Society

INFORMATION FOR REGISTRATION BADGE:

NICKNAME

FIRST NAME LAST NAME

BUSINESS AFFILIATION

STREET

CITY STATE *(U.S. only)*

MAILING ZONE COUNTRY (OTHER THAN U.S.)

BUSINESS CLASSIFICATION DATA FOR THE ABOVE REGISTRANT:

Please Check One Block Only Under Company And Under Position

YOUR COMPANY (CHECK ONE BLOCK ONLY)

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

YOUR POSITION (CHECK ONE BLOCK ONLY)

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

SPOUSES REGISTRATION AND INFORMATION FOR REGISTRATION BADGE:

D ☐ **SPOUSE** **$35.00**

SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:
H ☐ **$25.00**

NICKNAME

NAME

ADDRESS

CITY STATE

MAILING ZONE COUNTRY (OTHER THAN U.S.)

TICKETS FOR FEDERATION LUNCHEON, FRIDAY, OCTOBER 14 ($20 each)

Z ☐ **NUMBER OF TICKETS REQUIRED ________ @ $20.00 EACH.**

A CHECK IN THE AMOUNT OF U.S. $__________(U.S. BANKS) IS ENCLOSED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Tortured in the lab.
Proved in
the real world . . .
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FSCT
61st Annual Meeting
48th Paint Industries Show

Federation of Societies for Coatings Technology

POST-CONVENTION TOUR OF OLD QUEBEC

OCTOBER 15-17, 1983

Saturday, October 15

9:00 am -- Depart downtown Montreal hotel by charter bus for Quebec City, taking the scenic "Chemin du Roi" highway.

1:00 pm -- Approximate arrival at Quebec City -- Chateau Frontenac Hotel. No planned activities.

Sunday, October 16

2:00 pm -- Sightseeing tour of Quebec City and then to Ste. Anne de Beaupre Shrine.

Monday, October 17

10:00 am -- "Au Revoir" Quebec. Board bus for return to Montreal Airport (Dorval). Arrive approximately 12:30 pm (express route). Transportation to Mirabel Airport available from Dorval Airport.

PRICE:	$127.50 U.S. per person - twin occupancy $152.50 U.S. per person - single occupancy

Included:
- Round trip transportation by chartered bus.
- Two nights hotel accommodation, based on twin or single occupancy.
- Baggage handling in/out of hotel.

Deposit Required: $50 U.S. per person with Registration Form - plus optional Cancellation Insurance ($8.50) in case of illness.

Balance: Due before September 1, 1983. Cancellation Fee: Full amount after September 15th.

Tour Managed by: Bel-Air Travel, Inc., Beaconsfield, Que. (514-697-8116).

REGISTRATION FORM

F.S.C.T. QUEBEC TOUR - Attn. Patty Henchey, Mgr.
Bel-Air Travel, Inc.
50 St. Charles Rd.
Beaconsfield, Que., H9W 2X3, Canada

Office Use: ____________

Date: ________________

Name: ______________________________ Tel.: (   ) ______________

Address: ____

City: ______________________________ State: ______________

Country: ______________________ Mailing Code: ______________

Please Reserve: Twin ( )   Single ( ) for above.

CHECKS PAYABLE TO BEL-AIR TRAVEL, INC.:

Deposit Enclosed - Per P. $________
Cancellation Insurance $________

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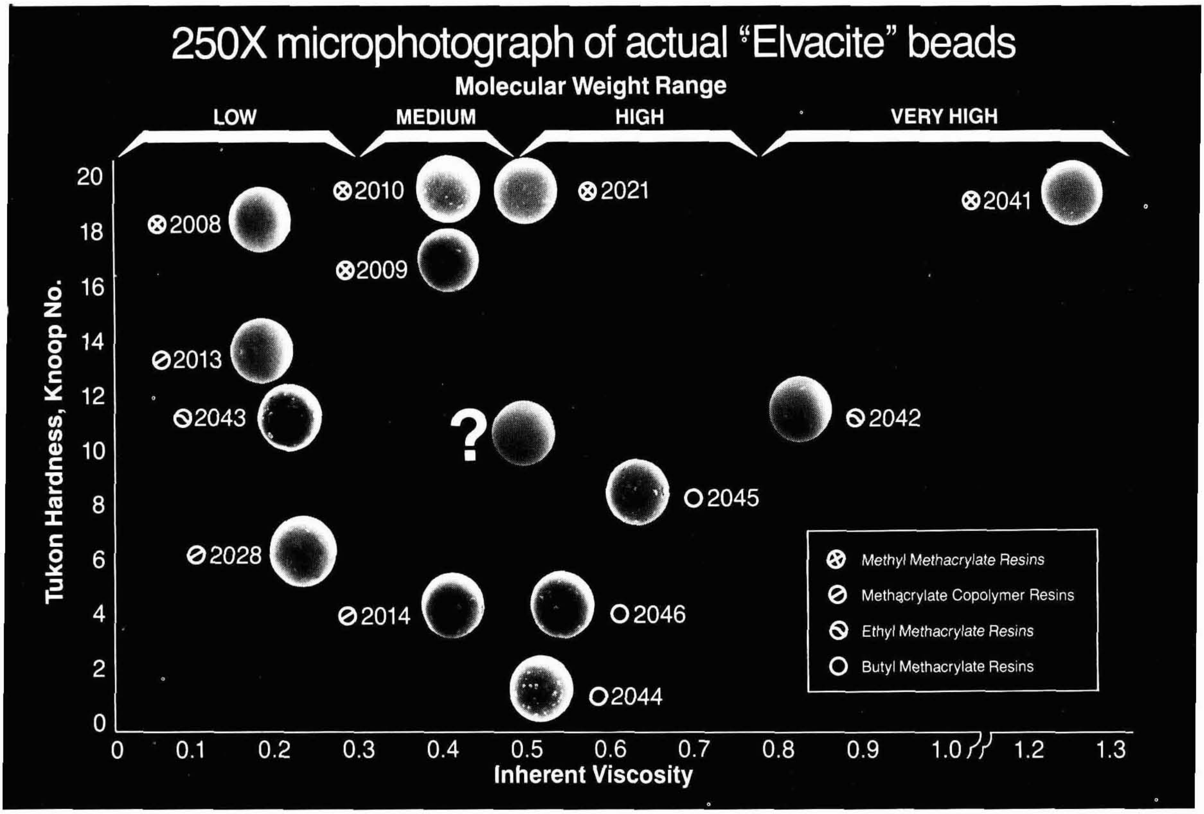

Uniform, small, spherical beads, for fast dissolving and dispersing.

Shown above are thirteen commercial grades of Du Pont Elvacite® acrylic resin beads. "Elvacite" resins offer you a broad spectrum of properties to match your specific application requirements. They have different chemical compositions in a wide range of molecular weights and polymer hardnesses.

Yet "Elvacite" beads are minute and uniformly spherical, which provides rapid dissolving and dispersal. And within each grade, the molecular weight variation is relatively narrow, providing uniform properties.

"Elvacite" beads give excellent clarity, durability and weatherability in end-use applications. These versatile beads are being used in coatings, adhesives, films, inks and temporary binders.

You may have some other applications in mind, however. If you have different requirements, we are ready to work with you in the development of other compositions—for extrusions, injection or compression moldings, for example, or for processing aids, and alloys. Or perhaps aqueous-alkali-soluble resins for water-base applications. Our 40-plus years of experience in developing acrylic resins can make a big difference to you.

Write for the "Elvacite" brochure with full technical information. Address: Du Pont Company, Room X39529, Wilmington, DE 19898. Or telephone, toll free, 1-800-345-8501. In Pennsylvania; 1-800-662-5180.

DU PONT
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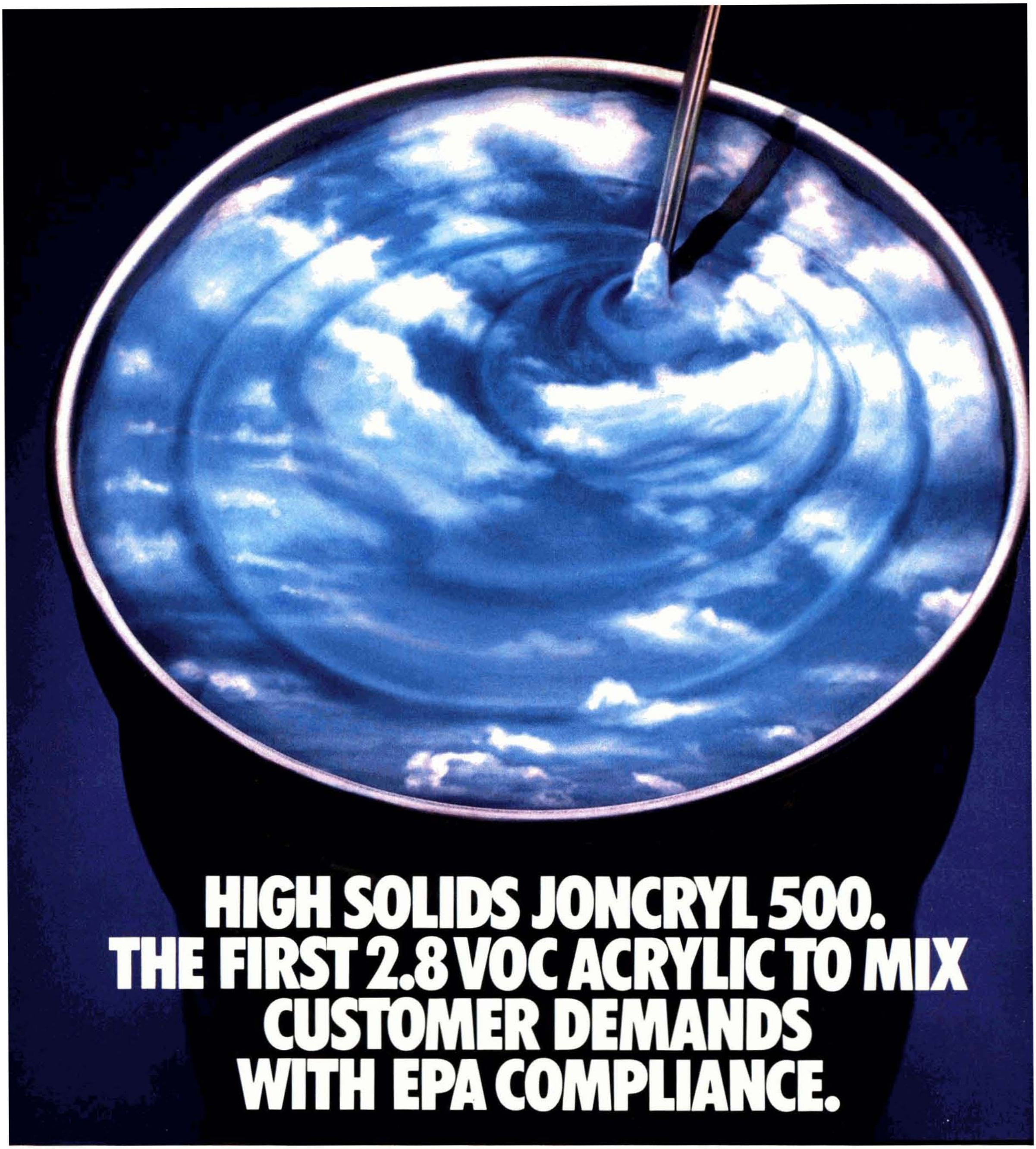

Now there's a unique thermosetting acrylic oligomer for conventionally applied high solids industrial coatings that meet EPA standards under the Clean Air Act.

Versatile. High solids coatings made with Joncryl 500 can even be applied with a conventional spray gun. At room temperature. No major investments or expensive equipment modifications are necessary. And Joncryl 500 is compatible with a variety of other resins for maximum formulating versatility.

So now for the first time there's a cost-effective way to meet the tough new EPA standards. Easily. Because Joncryl 500 reduces the Volatile Organic Compounds in high solids coatings to compliance levels. With no loss in product performance. You'll get all the acrylic durability, appearance and versatility without the typical high solids headaches.

Joncryl 500. It's the technological breakthrough that takes the smoke problem out of the oven, and the heat out of EPA compliance.

Joncryl 500 oligomer is the newest addition to the innovative line of polymer products from Johnson Wax.

Write or call for more information on Joncryl 500, or our complete line: Specialty Chemicals Group, Worldwide Innochem Operations, Johnson Wax, Racine, WI 53403. Telephone 414/631-3920.

Johnson wax
SPECIALTY CHEMICALS

We do much more than floors.

Example of Problem Solving Using Surface Analysis

Steven J. Valenty
General Electric Company*

The use of surface analytical instrumentation resulted in the solution of a plastics molding problem. By looking for differences between "good" and "bad" areas on the surfaces of a finely textured aluminum molding tool and a matching polymethylmethacrylate (PMMA) part, optical microscopy, scanning electron microscopy/energy dispersive X-ray analysis, Auger, and ESCA were able to show that a sulfur containing organic material was adhering to the tool. This film obscured fine mold detail and led to sticking. Gas chromatography, mass spectrometry, and X-ray fluorescence analysis determined the source of the sulfur to be one or more relatively volatile, low molecular weight compounds found in some PMMA formulations. After bonding a protective silicone coating to the surface of an unused aluminum tool, the PMMA parts separated cleanly without leaving a permanent residue. The thickness of the coating as measured by secondary ion mass spectrometry was 300–500 Å. This laboratory demonstration was successfully transitioned to the factory floor.

INTRODUCTION

Coatings are often designed to perform as protective barriers for the substrate, shielding it from hazards in whatever environment the article is expected to function. The operational lifetime of a device may be dependent solely upon the adhesion of this coating. A working description of such a critical applied surface phenomenon requires an approach in which measurement, modeling, and material/process changes form an interactive loop. Measurement provides the data base of performance tests, physical, mechanical, and chemical properties from which correlations can be drawn and testable hypotheses established. Models capable of predicting behavior can then guide the synthesis and formulation of coating/substrate materials as well as introduce process changes. Microscopy and a variety of surface analytical instrumentation have proven to be indispensable when making these measurements. A number of reviews have described various aspects of this approach.[1,2] The practical example presented here involved a plastics molding problem which was ultimately solved by bonding a thin protective coating onto the surface of the molding tool.

DESCRIPTION OF THE PROBLEM

Compression molding of a polymethylmethacrylate (PMMA) optical part designed to diffuse light when viewed in transmission resulted in the formation of bright spots characterized by a difference in or lack of surface diffusion texture. These optical defects were found at the same location on sequential parts pressed from the same textured aluminum die (*Figure* 1). Repeated pressings after the initial appearance of defects led to sticking of the part to the die. Such tools where shown to be permanently "stained" and useless for further production.

MEASUREMENT

Microscopic and spectroscopic comparisons were made of "good" and "defect" areas on both the aluminum tool and PMMA part. A cross-sectional optical micrograph shows the lenticular grooves cut into the aluminum (*Figure* 2). The finer texture produced by etching this surface is shown on the "good" area of the frontal micrograph of *Figure* 3. A similar comparison is shown for the PMMA part (*Figure* 4). The defect areas of both surfaces appear smoother than the adjacent good areas. When the aluminum surface is viewed by scanning electron microscopy (SEM), the "stained" area is marked

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*Corporate Research & Development Center, P.O. Box 8, Schenectady, NY 12301.

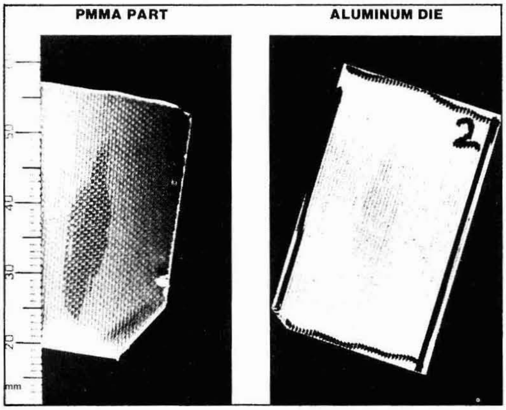

Figure 1—Photographs of corresponding defect areas on PMMA part and aluminum die

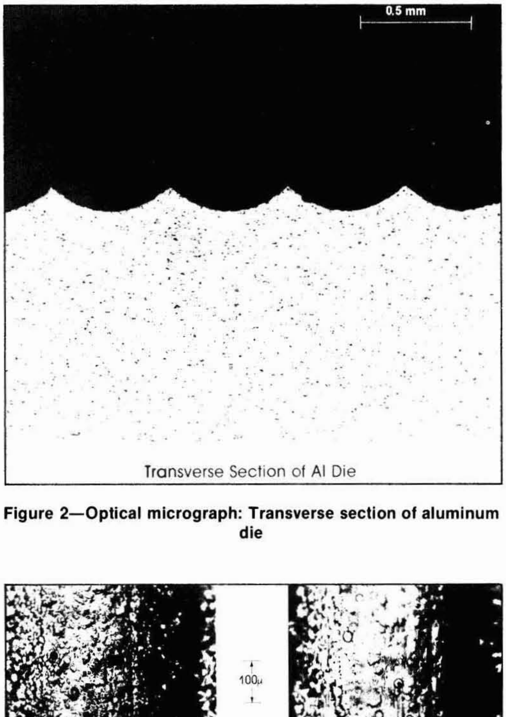

Figure 2—Optical micrograph: Transverse section of aluminum die

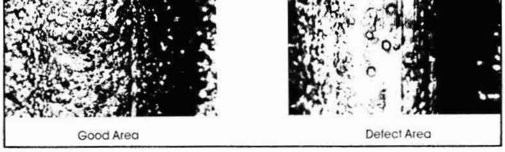

Figure 3—Optical micrographs: Comparison of "good" and "defect" areas on aluminum die after pressing

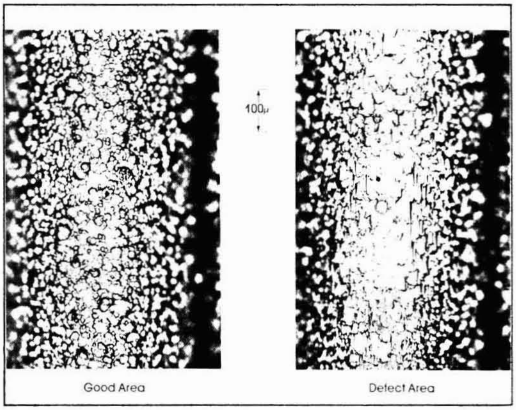

Figure 4—Optical micrographs: Comparison of "good" and "defect" areas on PMMA part

by black spots. A magnified picture of one such spot is shown in *Figure* 5. In stereo-pair viewing, the white filament at the top of this picture rises above the darker etch pit and an insulating film exhibiting charging behavior appears to be partially delaminated from the right side of the pit. Energy dispersive X-ray analysis (EDA) of the dark regions of the pit show the presence of sulfur there but not outside of the pit. Material of an organic nature appears to be filling the pit since "bubbling" and material flow are noted upon prolonged exposure to the electron beam. Auger analysis of this "stained" area confirmed the presence of sulfur and an enhanced amount of carbon containing material (*Figure* 6). No evidence of elemental aluminum was found on either the defect or good areas of PMMA parts by either SEM/EDA or Electron Spectroscopy for Chemical Analysis (ESCA). These results suggest that material from the resin is adhering to the aluminum surface.

The search for the source of the sulfur ended with the resin. The tendency to produce defects varied with resins from different manufacturers. Ultimately, the amount of low molecular weight materials volatile under molding conditions and the sulfur content of the resins was correlated with the quantity of defects produced. Gas chromatographic (GC) analyses of the volatiles entrained in a helium flow while heating the "best" and "worst" resin pellets at 215°C for 15 min are shown in *Figure* 7. While the presence of dioctyl phthalate (DOP) in the "best" resin was initially suspicious, adding DOP to the "worst" resin did not make its molding performance comparable to the "best" resin. GC-mass spectrometry (MS) confirmed that a major volatile component in the "worst" resin was a sulfur compound. "Bulk" analyses by X-ray fluorescence (XRF) and combustion showed the "best" resin had only 572 ppm sulfur while the "worst" had 728 ppm, or 27% more. Furthermore, the sulfur contents of the polymer after dissolution in methylene chloride and subsequent precipitation by methanol were 445 ppm and 354 ppm for the "best" and the "worst", respectively. Hence the "worst" resin had about 50% of its sulfur content in the soluble low molecular fraction while

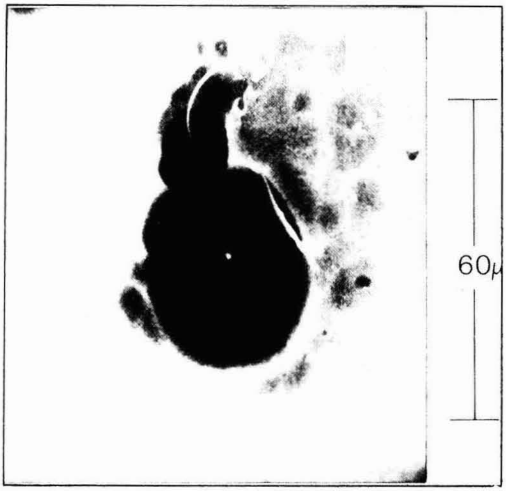

Figure 5—SEM: Etch pit on used aluminum die

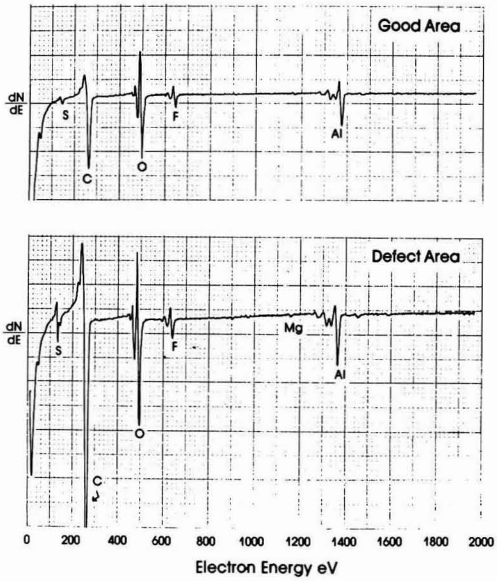

Figure 6—Auger analyses of "good" and "defect" areas on aluminum die after pressing

the similar fraction for the "best" had only 22% of the total. Resin manufacturers use small amounts of thiols (R-S-H) and disulfides (R-S-S-R) as chain transfer agents to control the molecular weight of the polymer. Normally, these sulfur compounds become incorporated into the resin as polymer chain end-caps via a thioether linkage.

HYPOTHESIS

Based on these data, it appeared that a chemical reaction occurs between the aluminum die surface and a component of the PMMA resin, probably a sulfur compound. This coupling chemistry leads to enhanced adhesion at the Al-PMMA interface which causes subsurface fracture in the PMMA part upon separation from the mold. The net result is the formation of a permanently bonded organic coating covering the etched aluminum surface which then transfers as a smooth area, an optical defect, to each succeeding PMMA replica.

TESTING OF THE HYPOTHESIS

A laboratory test was established to screen the ability of compounds to produce a permanent "stain" on the aluminum die whose geometry would transfer to the PMMA part as a smooth area upon pressing. Small (5 cm × 5 cm) pieces of an aluminum die were heated to 200° C in air on a hot plate to simulate the temperature and environment of the molding operation. The test materials were applied directly to the hot surface neat or in dilute solution and the excess quickly removed. Of the 30 materials selected for screening based upon what was known about the composition of the various resin formulations, only thiols produced a stain on the aluminum surface which visibly appeared to be the same

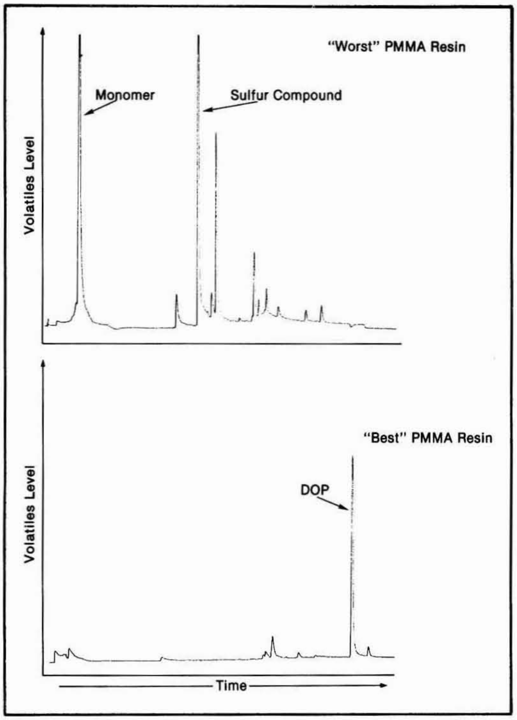

Figure 7—Gas chromatographic analyses of resin volatiles in "best" and "worst" materials

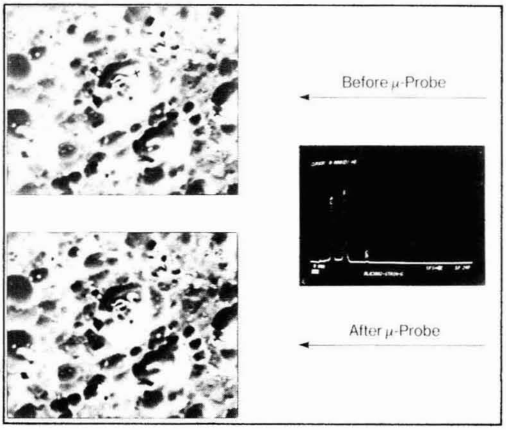

Figure 8—SEM/EDA analysis of lab stained aluminum die

as those resulting from PMMA pressings made in the factory. Microscopy and EDA showed the presence of a sulfur containing compound in the "stained" area (*Figure* 8). Note also the etch pit location marked with an "X" before the electron beam was focused onto this spot. Prolonged beam heating of thin organic films often induces melting and bubbling as observed by the formation of a hole where the "X" had been. Final validation of the hypothesis was obtained when test pressings of these laboratory "stained" aluminum pieces produced defects in PMMA parts having the same shape as the "stain".

THE SOLUTION

In laboratory survey experiments, the best means of protecting the aluminum die from chemical sulfur staining was achieved by bonding a silicone coating to the metal surface. A commercially available material, Frekote® 44, was applied as a fine atomized mist to the clean, dry aluminum surface heated to 40–55° C and then cured at 215° C. Upon applying a thiol containing compound to a heated 5 cm × 5 cm aluminum plaque, one half of which had been silicone coated, only the uncoated side was stained. Release properties and the optical appearance of parts made from coated tools were excellent. Long runs of parts could even be made successfully using the "worst" resin which in the past had started to adhere to the uncoated aluminum surface after only two or three pressings.

The carbon, hydrogen, and silicone elemental depth profiles, obtained by secondary ion mass spectroscopy (SIMS) for this coating on a smooth aluminum substrate with a native oxide layer, show it to have a coating thickness of about 300–500 Å. The thinness of this coating allows it to act as a barrier or passivating coating for the aluminum without covering up any of the fine texture necessary for uniform light diffusion.

An appreciation of surface science and technology continued to play a major role as this laboratory demonstration was transitioned to the factory floor. In particular, such understanding guided the design and implementation of processes and hardware for chemically bonding the coating to the large area molding tools.

ACKNOWLEDGMENT

I would like to thank my colleagues at the General Electric Corporate Research and Development Center for their contributions and support: J. J. Chera, C. Psyk, F. Bacon (Auger/ESCA), R. Bolon (SEM/EDA), D. Fink (Microscopy), M. Garbauskas (XRF), A. Holik (Microscopy), W. Katz (SIMS), W. Ligon (MS), E. Lovgren (Molding), R. May (MS-GC), C. Robertson (SEM/EDA), and G. Smith (SIMS).

References

(1) Kinloch, A.J., *J. Mat. Sci.*, *15*, 2141 (1980); *Ibid.*, *17*, 617 (1982).
(2) Larrabee, G.B., "Scanning Electron Microscopy," Vol. I, IIT Research Institute, Chicago, IL, March, 1977.

Frekote is a registered tradename of Frekote, Inc., Indianapolis, IN.

Colloid Chemistry Of Water-Reducible Coatings

Part I: Viscosity Behavior

James R. Overton
Eastman Chemicals Division[*]

and

Craig A. Herb
Owens-Corning Fiberglass Corporation[†]

The viscosity behavior was determined of an amine-neutralized polyester resin dissolved in ethoxyethanol when diluted with water. Typically complex viscosity dilution behavior was observed. Reasoning from dilute solution viscosity behavior, the concentration dependence of viscosity at constant water content, the viscosity shear rate dependence, and data on sedimentation by means of ultracentrifugation, a molecular interpretation of this phenomenon is offered. The data are explained in terms of conventional intermolecular segmental interactions at low water contents and aggregate formation at higher water contents.

INTRODUCTION

To determine the roles of organic cosolvents, resins, and neutralization agents in formulations of water-reducible coatings, it is necessary to understand, on a molecular scale, conditions that exist in these systems. One interesting feature of water-reducible coating formulations is the anomalous viscosity behavior observed when the resin-cosolvent is diluted with water. Rather than exhibiting a monotonic decrease in viscosity as the solids level is reduced, the viscosity/dilution relationship is complex and depends on the cosolvent/resin combination. Often one observes an initial viscosity decrease, followed by a rapid rise to a maximum with a subsequent precipitous drop. This behavior presents interesting theoretical, as well as practical, difficulties. The rapid viscosity decrease occurs through the use range 100–300 mPa sec. Therefore, to achieve a target viscosity, one must dilute the formulation to a properly selected extent.

Theoretical interpretation of this unusual viscosity dilution behavior has been the subject of several investigations.[1-3] Earlier works, reviewed by Hill, et al.,[1,3] have postulated that molecular aggregation occurs in the vicinity of the minimum viscosity, and that the subsequent increase to the maximum viscosity is the result of aggregate (or micelle) swelling and crowding. They suggested that at the viscosity maximum the molecular aggregates have swollen to their limit and, beyond that point, simple latex dilution results in a dramatic viscosity decrease. Results of the work reported here suggest an alternative interpretation.

EXPERIMENTAL

Formulation Ingredients

The resin used in this work was a low molecular weight, branched, carboxy terminated polyester developed by Eastman Chemical Products, Inc., as a recommended starting composition for customers producing water-reducible coating formulations. The composition and characterization parameters of the resin are given in *Table* 1. The organic cosolvent was 2-ethoxyethanol (Ektasolve® EE) and distilled water was used. The resin was neutralized in each case with triethylamine (TEA).

Preparation of Solutions

The solid resin was tumbled in 2-ethoxyethanol over a steam table until completely dissolved (~ 30 hr). The heated solution was filtered under pressure through a 1-μm Teflon® filter to remove dust and other solid impurities. Sufficient TEA was then added to provide 110% of the theoretical neutralization of the carboxy groups on the resin. The neutralized solution was then

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[*] Research Laboratories, Eastman Kodak Co., Kingsport, TN 37662.

[†] Technical Center, Cranville, OH 43023.

Table 1—Resin Composition

	Mole %
1,4-Cyclohexanedimethanol	35
Trimethylolpropane	12
Adipic acid	31
Phthalic anhydride	22
M_n	2900 (VPO)
Acid number	39 mg KOH/g resin
Hydroxyl number	56 mg KOH/g resin

tumbled over the steam table for one hour. The final solution contained 30% 2-ethoxyethanol by weight and 70% solids (i.e., $\Phi_S = 0.70$). Distilled water and additional 2-ethoxyethanol were added to this stock solution to produce the desired composition.

Equipment

With few exceptions, samples with viscosities above 100 mPa sec were measured on a Rheometrics mechanical spectrometer, whereas those with viscosities below 100 mPa sec were measured with one of two Cannon-Ubbelhode viscosimeters.

The Rheometrics instrument is a rotating rheometer and, for this work, was used with the CC-1 geometry. The CC-1 attachment has a combination concentric cylinder, and cone and plate geometry. The concentric cylinder gap and the cone angle are selected to provide the same shear rate at the same rotational speed for both sections. The shear rate for this geometry is given by $\sigma = 25\ \omega$, where σ is the shear rate in seconds^{-1} and ω is the rotational speed in radians/second. The two Cannon-Ubbelhode viscosimeters, B343 (size 75) and A431 (size 200), were appropriately calibrated.

The sedimentation velocity experiments were done with a Spinco Model E ultracentrifuge (Beckman Instruments, Inc.) using a titanium rotor at 25,980 rpm.

RESULTS AND DISCUSSION

When the stock solution ($\Phi_S = 0.70$, $f_w = 0.0$) was diluted with water, a typical viscosity dilution curve was produced. This is shown in *Figure* 1 as viscosity versus the weight fraction of water in the solvent, f_w. The bars in *Figure* 1 represent the regions in which shear rate dependence was observed. The shear rate dependence will be discussed in detail in a subsequent section. The exact shape of the curve depends on the particular cosolvent, amine, and resin used, the extent of neutralization, the weight fraction of resin in the stock solution, and temperature. However, as previously noted, the general trends always seemed to be the same. There was usually an initial viscosity decrease, followed by either a plateau region or an increase in viscosity, followed by an extremely rapid decrease. For the system discussed here, the

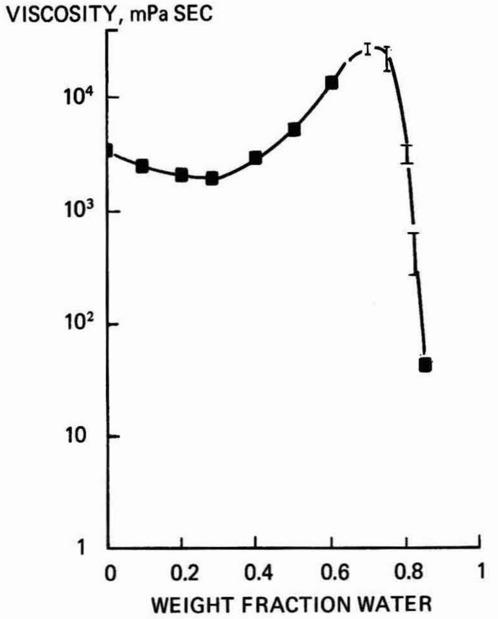


Figure 1—Viscosity dilution curve for the amine-neutralized polyester resin in ethoxy ethanol. Original solids level was 70%. The bars on the curve designate the regions of shear rate sensitivity

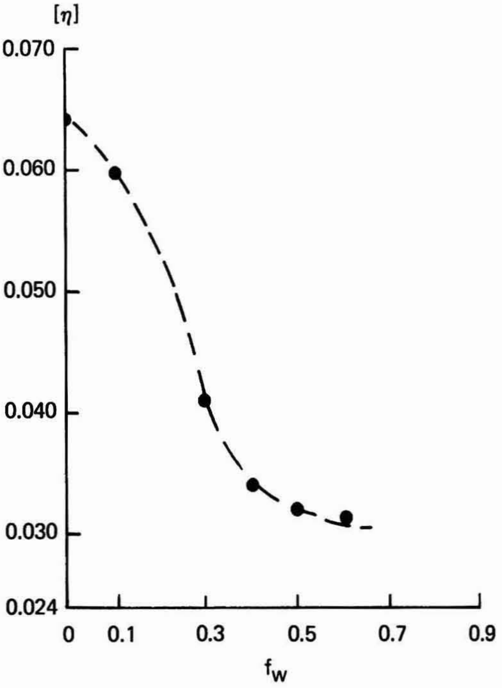


Figure 2—Inherent viscosity, [η], of the resin in 2-ethoxyethanol versus weight fraction of water, f_w. Concentration = 0.05 g/dL

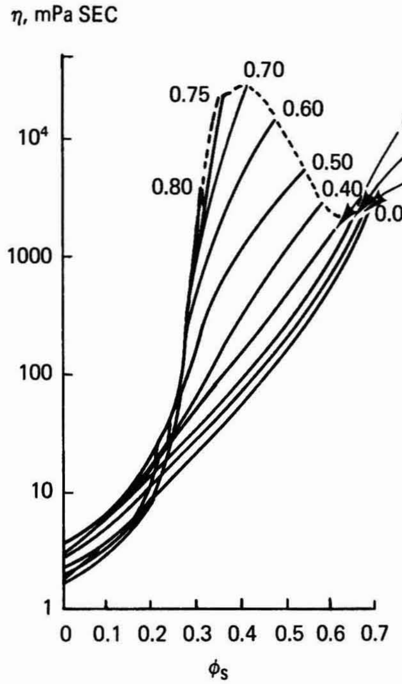


Figure 3—Viscosity at constant weight fraction of water versus resin concentration. Numbers on the lines represent water fractions

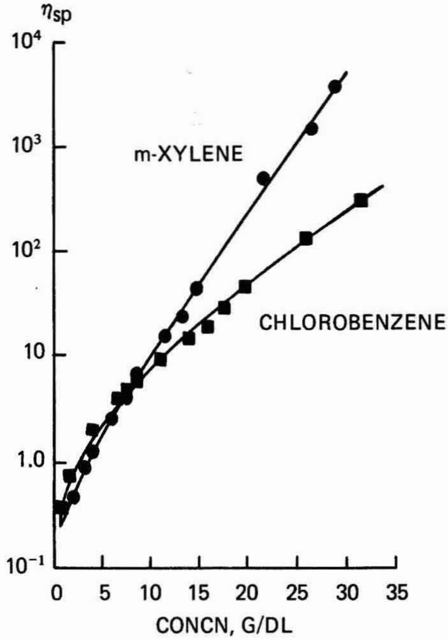


Figure 4—Specific viscosity versus concentration for poly(methyl methacrylate) in a good solvent, chlorobenzene, and a poor solvent, m-xylene[8]

increase was quite pronounced, going from 1900 mPa sec at the minimum ($f_w = 0.30$) to 28,000 mPa sec at the maximum ($f_w = 0.70$). Similar curves for a number of different systems can be found in the literature.[1-4] This type of graph is ideal for the coatings user, because it plots the path he will follow in diluting his formulation. However, it does not lend itself to easy interpretation because the solids fraction, Φ_S, and the water fraction in the solvent, f_w, are changing simultaneously.

Dilute Solution Viscosity As a Function of Cosolvent/Water Ratio

Viscosity enhancement of a solvent by a polymeric solute in dilute solution is due to the hydrodynamic resistance of the isolated solute molecules. Intermolecular interactions (solute-solute) are absent. The magnitude of viscosity enhancement is a direct reflection of the size of the molecule in the solvent. From the Flory-Fox relationship[4]

$$\langle\eta\rangle = \frac{\Phi \langle R^2\rangle^{3/2}}{M} \qquad (1)$$

one can see that variations in viscosity for a given polymer (of constant molecular weight) in different solvents are due to expansion or contraction of the polymer molecule as reflected in changes in the mean square radius of gyration, $\langle R^2\rangle$. In equation (1), $\langle\eta\rangle$ is the intrinsic viscosity, Φ is a universal constant, and M is the

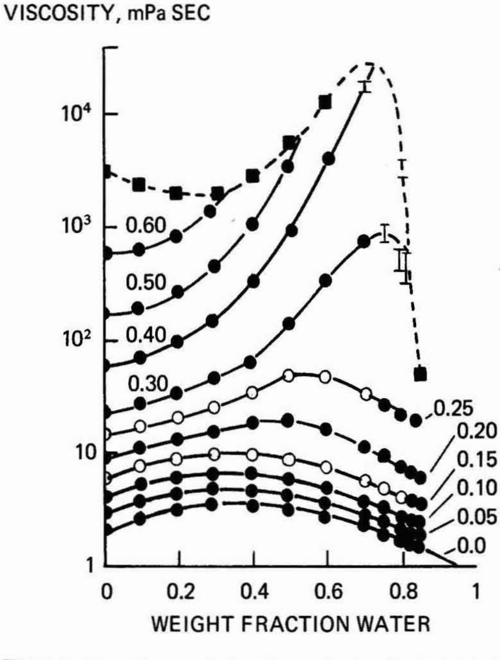


Figure 5—Dependence of viscosity on f_w at various constant values of Φ_S

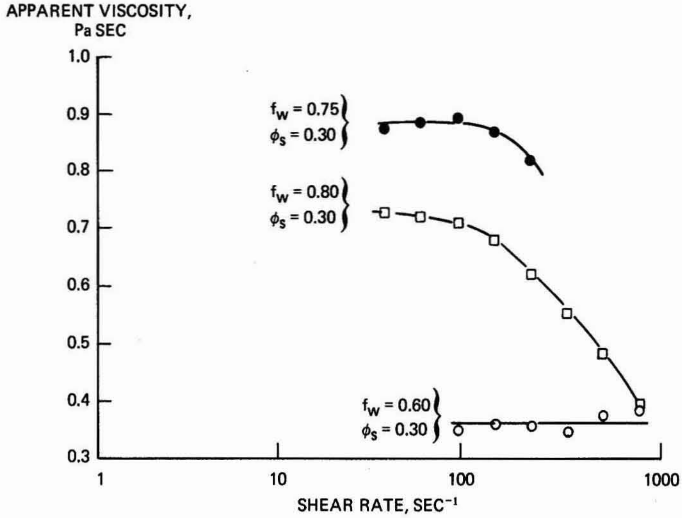


Figure 6—Viscosity versus shear rate at various solids levels (Φ_S) and various weight fractions of water (f_w)

molecular weight. The equation is not strictly applicable to this system because the chain length of the polyester resin is not sufficiently long for the segment density distribution to be gaussian. This equation is used here only to illustrate that dilute solution viscosity is determined by the ratio of molecular volume to molecular mass.

Figure 2, shows the inherent viscosity, $[\eta]$, (0.5 g/dL) of our polyester resin as a function of water content in the solvent. Intrinsic viscosity is the inherent viscosity extrapolated to zero concentration.

As the water content of the solvent increases, the inherent viscosity decreases from 0.064 dL/g to 0.031 dL/g. Thus, as f_w increases from 0.0 to 0.6, the volume of a given solute molecule $(\langle R^2 \rangle)^{3/2}$ decreases by about a factor of two. Thus, a water-rich solvent mixture is a poorer thermodynamic solvent for the resin than is the organic cosolvent. Intramolecular segment-segment contacts are energetically more favorable in the water-rich system, and thus the molecules contract.

Concentration Dependence Of Viscosity at Constant f_w

The concentration dependence of viscosity at constant f_w for different levels of f_w is shown in *Figure* 3. This method of data presentation has also been used by Brandenburger, et al.[4b] The obvious conclusion from these data is that the higher the value of f_w, the higher the concentration dependence of the viscosity. The dilute solution viscosity data show that as f_w increases, the thermodynamic solvent power of the mixture for the resin decreases. Thus, it is concluded that the poorer the thermodynamic power of the solvent, the greater the concentration dependence of viscosity. Although this might seem a surprising result, it is in fact quite general and has been observed by numerous investigators for various polymers in good and poor solvents.[5-7] As an example, *Figure* 4 shows data from Gandhi and Williams[7] for poly(methyl methacrylate) in the good solvent, chlorobenzene, and poor solvent, m-xylene. Note that the dilute solution viscosity is higher in the good solvent, chlorobenzene. At high solids, however, the viscosity is higher by an order of magnitude in the poor solvent, m-xylene.

Dependence of Viscosity On f_w at Constant Φ_S

Figure 5 shows the effect of cosolvent/water ratio at constant solids for the different solids levels. At low solids levels, $\Phi_S < 0.20$, the viscosity curve mimics that of the cosolvent/water mixture at zero solids. Above $\Phi_S = 0.20$, however, one observes viscosity enhancement at constant solids as f_w increases. This is another illustration of the effect of solvent power on viscosity in the high-solids regime.

Dependence of Viscosity on Shear Rate

Using the mechanical spectrometer, the shear rate dependence of viscosity across the dilution curve was determined. Some of these data are shown in *Figures* 6 and 7. Over the range of shear rate investigated, our system exhibits non-Newtonian behavior only at the maximum viscosity and beyond (higher f_w). We conclude from this result and other data that aggregate formation occurs at the maximum viscosity, and that viscosity decreases rapidly as the result of aggregate dilution when additional water is added.

Ultracentrifugation

To obtain direct evidence of molecular aggregation, sedimentation velocity experiments at $\Phi_S = 0.005$ for cosolvent/water ratios over the entire range were conducted. The number average molecular weight of the

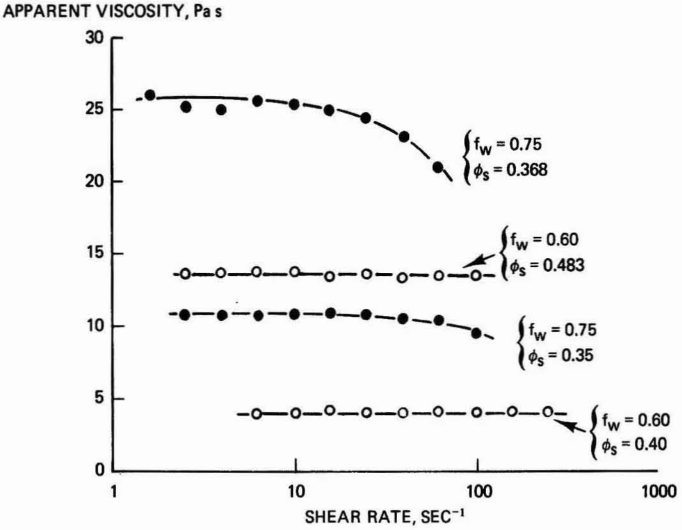


Figure 7—Viscosity versus shear rate at various solids levels (Φ_S) and various weight fractions of water (f_w)

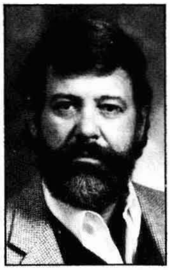
resin was 2900 daltons. A polymer of such low molecular weight will not sediment under the conditions used (25,980 rpm). If several tens of molecules aggregate to form micelles or molecular aggregates, however, sedimentation will occur provided, of course, there is a sufficient density difference between the aggregates and the continuous phase. In these experiments no evidence was noted of sedimentation until the water content approached that which gives the maximum viscosity (f_w = 0.70). For all values of $f_w > 0.70$, distinct sedimentation patterns were observed.

CONCLUSIONS

Dilute solution viscosity measurements demonstrate that the addition of water to 2-ethoxyethanol decreases the solvating power of the solvent for the resin. Intrasegmental contacts become more energetically favorable, which leads to molecular contraction, and thus a diminution of solution viscosity. We conclude that thermodynamically, the solvent system changes from a relatively good solvent at $f_w = 0.0$ to a poor solvent as f_w increases.

When the concentration dependence of the viscosity at constant water content was examined for different water levels, it was found that the higher the water content (i.e., the poorer the solvent), the greater the concentration dependence. Other investigators have found this behavior to be general when comparing the concentration dependence of viscosity in good and poor solvents.[5-7]

The dashed line connecting the constant f_w lines in *Figure* 3 is the path followed by the standard dilution curve. The reason for the complexity of this curve is now apparent. As water is initially added (from $f_w = 0.0$ to $f_w = 0.20$), the concentration dependence of viscosity changes very little, and the observed viscosity decrease is due to the reduction in solids level. In the region between $f_w = 0.30$ and $f_w = 0.70$, the concentration dependence of the viscosity increases so rapidly that it outweighs the dilution effect, and the net result is a viscosity increase. Near the viscosity dilution curve maximum ($f_w = 0.70$), a phase transition occurs leading to micelle formation with the predictable precipitous viscosity decrease and the onset of shear rate sensitivity. The ultracentrifuge patterns clearly reveal micelle formation for values of $f_w > 0.70$.



DR. JAMES OVERTON is a Research Associate with the Chemicals Division of the Eastman Kodak Company in their Research Laboratories in Kingsport, TN. He earned the Ph.D. Degree in Physical Chemistry from the University of South Carolina. His research interests include polymer characterization, rheology, and polymer morphology.

DR. CRAIG HERB is a Senior Engineer with Owens-Corning Fiberglas Corp. at their Technical Center in Granville, Ohio. He earned the Ph.D. Degree in Chemical Engineering from Rensselaer Polytechnic Institute in 1978 and held the position of Research Chemical Engineer with Tennessee Eastman Co. in Kingsport, TN through 1981. His research at Eastman dealt with the colloidal and surface properties of water-borne coating formulations and textile-dye dispersions, as well as the surface properties of polymer fibers.

The molecular interpretation, therefore, of the complexity of the viscosity dilution curve is reduced to the interpretation of the strong dependence of viscosity on concentration in thermodynamically poor solvents. We believe that the energetics that favor intramolecular segment-segment interaction and molecular contraction in dilution solution, lead to favorable intermolecular contacts in concentrated solution. These interactions lead to the formation of a transient, three dimensional network that results in viscosity enhancement. We emphasize the word transient. The relaxation times of these intermolecular contacts are fast compared to the shear rates we used. If this were not the case, viscosity shear rate dependence would have been observed in this region. Although these interactions are the same as those that eventually lead to aggregate formation for this system in the region of $f_w > 0.70$, we believe that it is inappropriate to attribute the viscosity behavior between $f_w = 0.30$ and $f_w = 0.70$ to aggregation followed by aggregate swelling. This interpretation clearly does not preclude the formation of aggregates in the region of viscosity enhancement for other systems. Recent work by Wicks, et al.[8] provides convincing evidence of aggregation in the case of water soluble acrylics. We suggest that aggregation per se is not the cause of viscosity enhancement, but rather that both effects are independently related to the decrease in the solvating power of the solvent system. The extent to which the two overlap will be unique for each system investigated.

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(7) Gandhi, K.S. and Williams, M.C., "Solvent Effects on the Viscosity of Moderately Concentrated Polymer Solutions," *J. Polymer Sci.*, Part C, *35*, 211-234 (1971).

(8) Wicks, Z.W., Anderson, E.A., and Culhane, W.I., "Morphology of Water-Soluble Acrylic Copolymer Solutions," JOURNAL OF COATINGS TECHNOLOGY, *54*, No. 688, 57 (1982).

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High Solids Coatings From New Oligomers

M.S. Chattha and J.C. Cassatta
Ford Motor Company*

A tetrahydroxy oligomer was prepared by reacting the reaction product of 2-ethyl-1,3-hexanediol and methylhexahydrophthalic anhydride with 1,4-butanedioldiglycidyl ether. This oligomer was crosslinked with hexamethoxy melamine to obtain coatings containing 350 to 400 g/L (2.9 to 3.4 lb/gal) volatile organic compounds (VOC) with excellent physical properties. The accelerated weathering performance of these coatings is comparable to that of high solids acrylic-melamine coatings.

In order to further increase the solids content of high solids coatings, a new difunctional oligomer was synthesized by the reaction of one mole of methylhexahydrophthalic anhydride with two moles of 2-ethyl-1,3-hexanediol. Incorporation of this oligomer to the above paint composition has provided coatings containing 320-400 g/L (2.7 to 3.4 lb/gal) VOC.

INTRODUCTION

High solids single-component coatings have manufacturing and application characteristics similar to present day low solids coatings, which may allow adaptation of existing application and baking facilities. In order to attain adequate spray viscosity in high solids coatings, low molecular weight polymers (oligomers) are employed for their formulation.[1] In this paper, the synthesis and use of two new oligomers for single component high solids coatings are described.

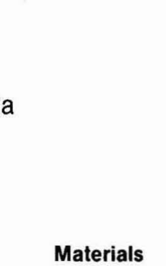
Materials

2-Ethyl-1,3-hexanediol **1** was brought from Eastman Kodak Co. and dried over molecular sieves before use.

$$HOCH_2-\overset{C_2H_5}{CH}-\underset{OH}{CH}-CH_2-CH_2-CH_3$$

1

Methylhexahydrophthalic anhydride **2** was



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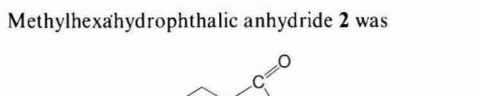
obtained from Veba Chemie AG (W. Germany) and methoxymethyl melamines (Cymel® 301 and Cymel 325) were obtained from American Cyanamid Co.

1,4-Butanedioldiglycidyl ether **3** (Araldite® RD-2) and



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stabilizers CGL 079L and CGL 900 were received from CIBA-GEIGY Corp. A hydroxy acrylic polymer ($\overline{M}_n \simeq 2000$) was prepared by conventional solution polymerization (30% hydroxypropyl methacrylate) in methyl amyl ketone at 80% solids by weight. A white mill base of the following composition was prepared from this polymer: titanium dioxide 72.5%, polymer 10.2%, solvent

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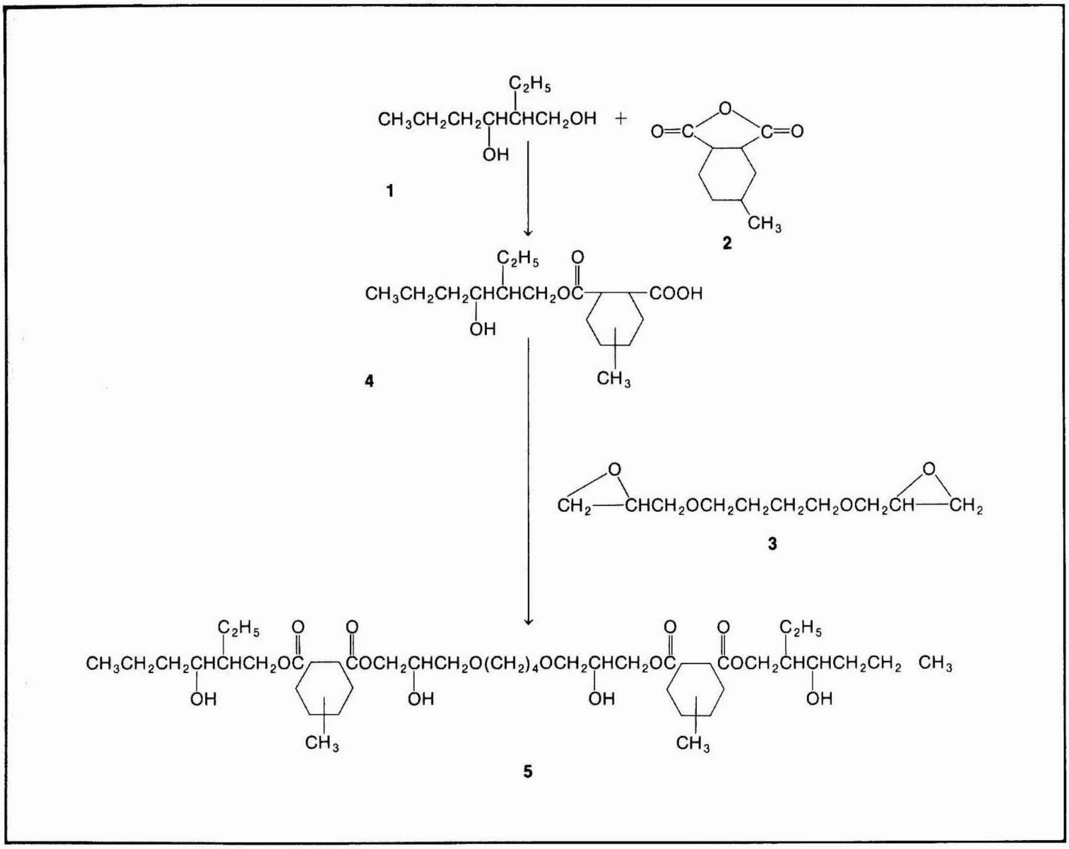
*Engineering and Research Staff, 20000 Rotunda Dr., Dearborn, MI 48121.



Scheme I

17.3%. A proprietary nonaqueous dispersion (NAD) type flow control additive was obtained from Ford Paint Plant, Mt. Clemens, MI.

Preparation of Tetrol 5 *(Scheme I)*

2-Ethyl-1,3-hexanediol (2920 g, 20 moles) was placed in a 12 litre flask and was heated to 100°C. Methylhexahydrophthalic anhydride (3360 g, 20 moles) was added dropwise with continuous stirring and maintaining the temperature at about 100°C. The reaction mixture was stirred at this temperature for two hours and then 2680 g of 1,4-butanedioldiglycidyl ether containing three grams of Cordova Accelerator AMC™-2 was added dropwise with continuous stirring. After the addition was complete, the reaction mixture was stirred at 100°C for three hours and then heated at 165°C for four hours. The molecular weight of the resulting product from gel permeation chromatography was found to be $\overline{M}_n = 410$, $\overline{M}_w = 807$.

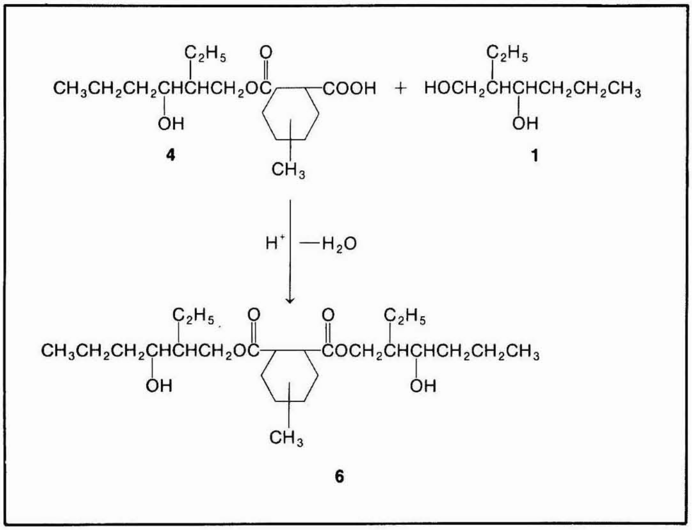
Preparation of Diol 6 *(Scheme II)*

Methylhexahydrophthalic anhydride (1260 g, 7.5 moles), 2-ethyl-1,3-hexanediol (2190 g, 15 moles), and xylene (350 g) were placed in a round-bottom flask and the reaction mixture was heated at 70°C for 16 hours. Four grams of tetraisopropyl titanate (Tyzor® TPT, E. I. duPont de Nemours & Co., Inc.) were added to the reaction flask and it was fitted with a Dean-Stark water separator. The reaction mixture was heated at 200°C and water was collected continuously until no more water separated (12 hours). Part of the xylene (197 g) was also distilled off, and the acid number of the resulting product from alkali titration was found to be 1.5. The molecular weight of the product from gel permeation chromatography, with polypropylene glycol as standard, was found to be $\overline{M}_n = 462$, $\overline{M}_w = 517$.

Paint Formulation

Coatings compositions were prepared by crosslinking the hydroxy polymer, oligomers **5** and **6**, and their

Scheme II



mixtures with Cymel 301 or Cymel 325; the detailed compositions are described in the Appendix.

The paints were applied by spraying under air pressure with a suction gun to primed (ester-epoxy primer) steel panels in three coat applications; intermediate flash time was one minute and final flash was five minutes. The panels were baked in an air circulating oven at 130° C for 17 minutes; the properties are listed in *Table* 1 in the Appendix. All coatings exhibited excellent resistance to xylene and methyl ethyl ketone and none showed any blistering, discoloration, or loss of gloss for 14 days in the Cleveland Humidity Chamber.

Accelerated Weathering

The paint panels were evaluated in Q-Panel Company's QUV® Cyclic Weathering Tester by exposing them alternately to eight hours of ultraviolet light at 60° C and then four hours of condensing humidity for a total of 2,000 hours. Percentage gloss/20° was recorded at various intervals of time, and the results have been plotted in *Figures* 1–4.

RESULTS AND DISCUSSION

The primary hydroxy group of 2-ethyl-1,3-hexanediol, **1**, reacts preferentially with methylhexahydrophthalic anhydride **2**, to produce hydroxy acid **4** (*Scheme* I). Reaction of **1** with **2** can be followed conveniently with infrared spectroscopy. The spectrum of the reaction mixture of **1** and **2**, shortly after mixing at room temperature, shows a strong absorption for the anhydride moiety at 1860 cm^{-1} (*Figure* 5).[2] This absorption disappears upon heating (*Figure* 6) to produce hydroxy acid **4**. When two moles of **4** are reacted with one mole of 1,4-butanedioldiglycidyl ether **3**, tetrahydroxy oligoester **5** is produced by the reaction of the acid groups with the epoxy moieties. The extent of

Table 1—Paint Properties

Composition	Cymel 325 Based					Cymel 301 Based		
Hydroxy Resins	(A) Oligomer 5	(B) Oligomer 6	(C) Oligomers 5 & 6	(D) Hydroxy Polymer	(E) Oligomer 6 Hydroxy Polymer	(F) Oligomer 6	(G) Oligomers 5 & 6	(H) Oligomer 6 & Hydroxy Polymer
Viscosity, Sec.								
#4 Ford Cup	36	39	40	55	37	30	37	43
VOC lb/gal	3.2	2.9	3.0	3.6	3.4	2.8	2.7	3.4
(g/L)	381	346	358	430	405	334	322	405
Gloss/20°	82	85	78	76	79	72	69	67
Impact, direct, M-Kg	0.23	0.27	0.23	0.27	0.35	0.27	0.23	0.23
(in lbs)	20	24	20	24	30	24	20	20
Hardness, Pencil	3H	3H	3H	3H	H	H	HB	HB
QUV, Weathering	(See *Figures* 1–4)							

Cleveland Humidity: None of these paint compositions showed any loss of gloss, blistering, or discoloration.

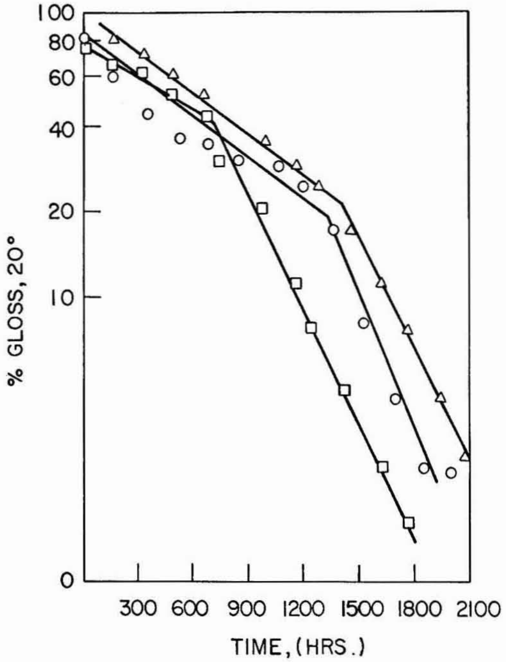


Figure 1—Accelerated weathering (QUV) of oligomer *6*-Cymel 325 composition △, oligomer 5-Cymel 325 composition ○, and acrylic-Cymel 325 paint composition ☐

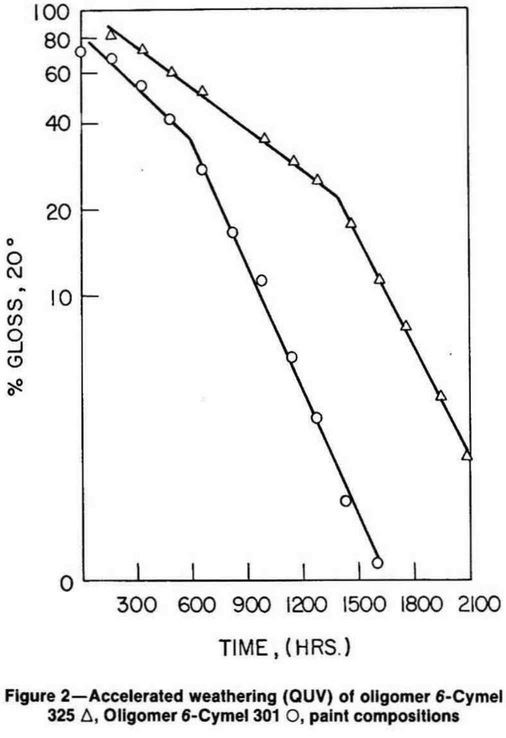


Figure 2—Accelerated weathering (QUV) of oligomer *6*-Cymel 325 △, Oligomer *6*-Cymel 301 ○, paint compositions

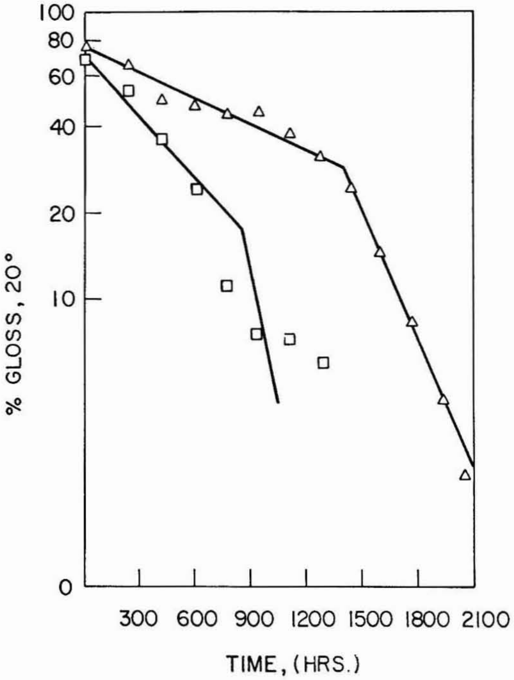


Figure 3—Accelerated weathering (QUV) of oligomer *5*-oligomer *6*-Cymel 325 △, and oligomer *5*-oligomer *6*-Cymel 301 ☐, paint compositions

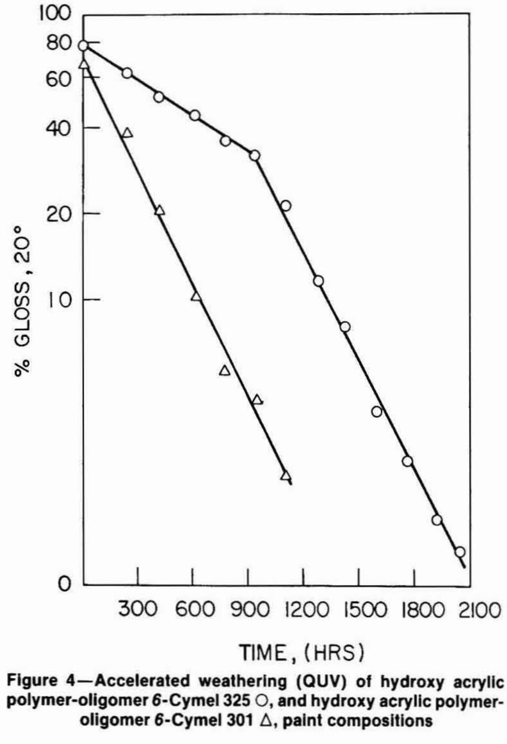


Figure 4—Accelerated weathering (QUV) of hydroxy acrylic polymer-oligomer *6*-Cymel 325 ○, and hydroxy acrylic polymer-oligomer *6*-Cymel 301 △, paint compositions

Errata

In the article, "High Solids Coatings from New Oligomers," by M.S. Chattha and J.C. Cassatta (May 1983, pp 39–46), figures 5, 6, and 7 are out of sequence. They should read:

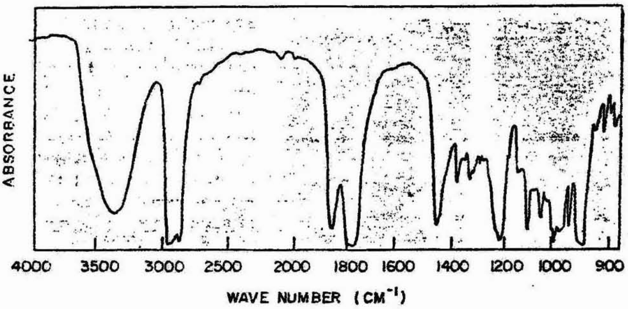


Figure 5—Infrared spectrum of mixture of 2-ethyl-1,3-hexanediol and methylhexahydrophthalic anhydride immediately after mixing at room temperature

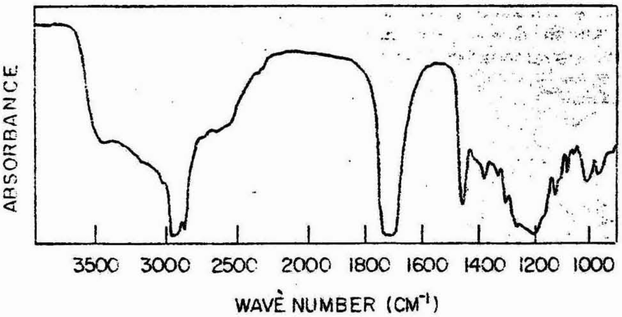


Figure 6—Infrared spectrum of the mixture described in *Figure* 1 after heating at 100°C for two hours

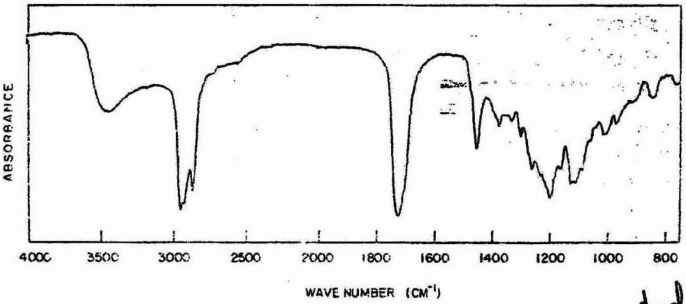


Figure 7—Infrared spectrum of the tetrahydroxy oligomer 5

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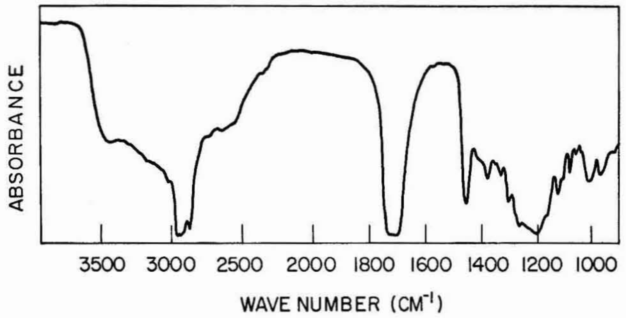


Figure 5—Infrared spectrum of mixture of 2-ethyl-1,3-hexanediol and methylhexahydrophthalic anhydride immediately after mixing at room temperature

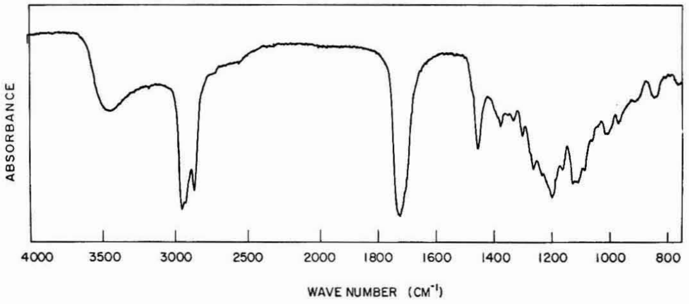


Figure 6—Infrared spectrum of the mixture described in *Figure* 1 after heating at 100°C for two hours

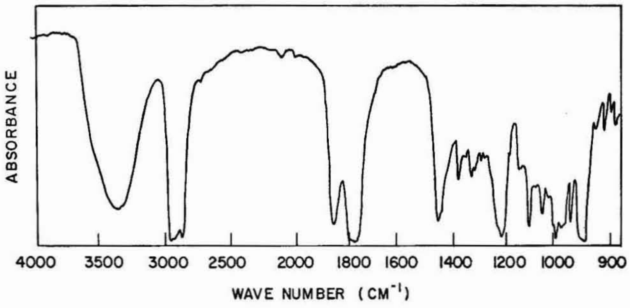
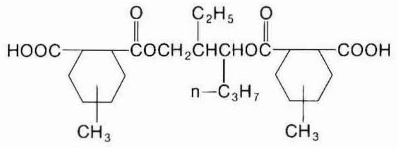


Figure 7—Infrared spectrum of the tetrahydroxy oligomer *5*

completion of the reaction can be followed by the disappearance of the acid and epoxy (910 cm^{-1})[2] absorption bands (*Figure* 7).

When two moles of starting diol **1** are treated with one mole of anhydride **2** and the mixture is subsequently refluxed in xylene, under a Dean-Stark water separator, diol **6** is produced according to *Scheme* II. Infrared spectrum of **6** is shown in *Figure* 8.

Although reaction of **1** and **2** has been shown (*Scheme* I) to produce hydroxy acid **4** only, in reality this reaction would produce a mixture of isomeric hydroxy acids depending upon the anhydride ring opening relative to the ring-methyl group and also due to some secondary hydroxy group reaction with the anhydride. In addition to these isomers resulting from the attack of the primary and/or the secondary groups on the anhydride, dimeric acids **7**



7

would also be produced by the reaction of **2** with hydroxy acid **4**. Formation of diacids **7** would leave some unreacted diol **1** in *Schemes* I and II. This is supported by gel permeation chromatographs of tetrol **5** (*Figure* 9) and that of diol **6** (*Figure* 10), both of which show peaks for low molecular weight components. The chromatograph of **5** (*Figure* 9) shows low molecular weight impurities in addition to the starting 2-ethyl-1,3-hexanediol **1**. These

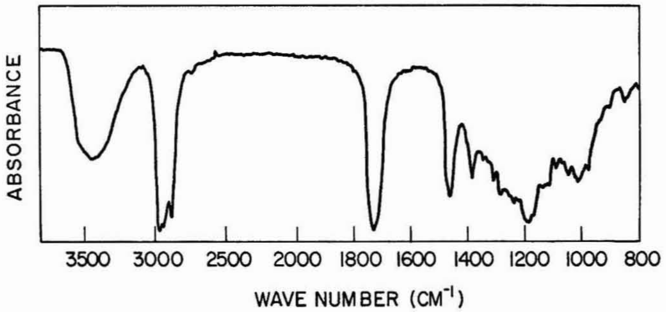


Figure 8—Infrared spectrum of the dihydroxy oligomer *6*

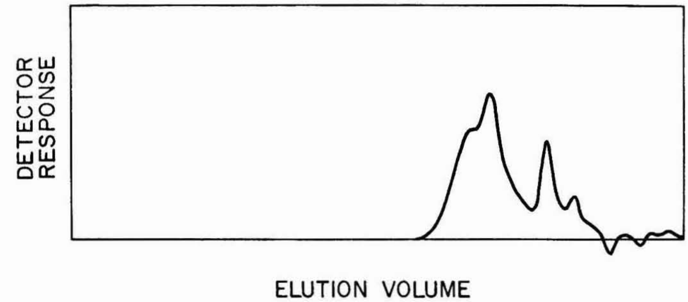


Figure 9—Gel permeation chromatograph of tetrahydroxy oligomer *5*

products may be due to impurities in the commercial epoxy **3** employed in the synthesis.

In the curing of coating composition from oligomers **5** and **6**, the hydroxy acrylic polymer and methoxymethyl melamines, crosslinks are produced by the condensation of hydroxy and methoxymethyl groups.[3]

Since Cymel 301 requires a strong catalyst,[4,5] p-toluenesulfonic acid was employed to catalyze its formulations. Cymel 325 based formulations were catalyzed with phenyl acid phosphate since this melamine has been developed to be cured by weak catalysts.[4]

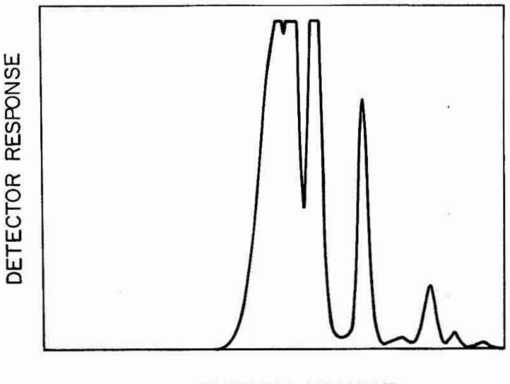


Figure 10—Gel permeation chromatograph of dihydroxy oligomer *6*

The paint compositions with oligomer **5** or oligomer **6** and Cymel 325 (350 to 400 g/L VOC; 2.9 to 3.4 lb/gal) exhibit higher gloss retention (*Figure* 1) in accelerated weathering (QUV) than the hydroxy acrylic polymer and Cymel 325 paint composition. Cymel 301 and oligomers **5** or **6** formulations provide still higher solids (*Table* 1); however, accelerated weathering of these coatings is inferior to those formulated with Cymel 325 (*Figure* 2). A similar weathering pattern is seen when mixtures of oligomers **5** or **6** are crosslinked with Cymel 301 and with Cymel 325 (*Figure* 3). Addition of hydroxy acrylic polymer to the formulations containing oligomer **5** or oligomer **6** still does not change the accelerated weathering pattern as seen from *Figure* 4. All these formulations contain some of this hydroxy acrylic polymer from the mill base. The higher gloss retention of Cymel 325 formulations is probably due to its higher molecular weight and due to better retention of network integrity in weathering resulting from its self-condensation.[6]

CONCLUSIONS

Dihydroxy and tetrahydroxy oligomers can be conveniently prepared by the reaction of 2-ethyl-1,3-hexanediol, methylhexahydrophthalic anhydride, and 1,4-butanediol diglycidyl ether. These oligomers can be crosslinked with Cymel 325 to obtain coatings containing 350 to 400 g/L (219 to 3.4 lb/gal) VOC. Paints with still higher solids (320 g/L, 2.7 lb/gal VOC) can be obtained by crosslinking these oligomers with Cymel 301; however, accelerated weathering (QUV) of Cymel 301 based compositions is inferior to those of Cymel 325 based paints. Weathering (QUV) of Cymel 325 based formulations (white) containing these oligomers is superior to that of experimental single component acrylic-melamine high solids paints.

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(2) Silverstein, R.M. and Bassler, G.C., "Spectrometric Identification of Organic Compounds," John Wiley & Sons, Inc., 1967, p. 74–75.

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(4) Blank, W.J., "Reaction Mechanism of Melamine Resins," JOURNAL OF COATINGS TECHNOLOGY, *51,* No. 656, 61 (1979).

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(6) Bauer, D.R., *J. App. Polymer Sci.,* in press.

APPENDIX

PAINT COMPOSITIONS

Phenyl acid phosphate (40% in isobutanol) and p-toluene sulfonic acid (40% in 2-propanol) were employed as paint catalysts; stabilizer CGL 900 (10% in xylene) and CGL 079L (40% in xylene) were incorporated in all the paint compositions to attain improved paint durability.

FORMULATION A

	wt. g
Tetrahydroxy oligomer **5**	83
Cymel 325	38
Flow control additive (NAD)	30
Mill base	90
Phenyl acid phosphate solution	2.7
Polybutyl acrylate solution (55% in xylene)	3.6
Stabilizer CGL 900 solution	19.2
Stabilizer 079L solution	6.5
Solvent*	11.0

	wt. %
*Cellosolve acetate	35
Methyl amyl ketone	35
Ethyl alcohol	20
Butyl acetate	11

FORMULATION B

	wt. g
Dihydroxy oligoester **6**	76.2
Cymel 325	40.2
Mill base	75.0
Flow control additive (NAD)	54.1
Stabilizer CGL 079L solution	4.9
Stabilizer CGL 900 solution	19.8
Phenyl acid phosphate solution	2.5

The above mixture was diluted with butyl acetate to bring the viscosity to 39 sec. #4 Ford Cup.

FORMULATION C

	wt. g
Tetrahydroxy oligomer **5**	62.5
Dihydroxy oligomer **6**	20.1
Cymel 325	32.8
Mill base	75.0
Flow control additive (NAD)	52.4
Stabilizer CGL 079L solution	4.7
Stabilizer CGL 900 solution	19.2
Phenyl acid phosphate solution	1.7

Butyl acetate was added to the above mixture to bring the viscosity to 40 sec. #4 Ford cup.

FORMULATION D

	wt. g
Hydroxy acrylic polymer	45.00
Cymel 325	13.4
Mill base	52.0
Flow control additive (NAD)	18.8
Stabilizer CGL 079L solution	1.1
Stabilizer CGL 900 solution	4.3
Phenyl acid phosphate solution	0.5

Butyl acetate was added to the above mixture to bring the viscosity to 55 sec. #4 Ford cup.

FORMULATION E

	wt. g
Dihydroxy oligomer **6**	20.1
Hydroxy acrylic polymer	70.6
Cymel 325	32.8
Mill base	75.0
Flow control additive (NAD)	52.3
Stabilizer CGL 079L solution	4.7
Stabilizer CGL 900 solution	19.7
Phenyl acid phosphate solution	1.4

Butyl acetate was added to the above mixture to bring the viscosity to 40 sec. #4 Ford cup.

FORMULATION F

	wt. g
Dihydroxy oligomer **6**	76.2
Cymel 301	32.1
Mill base	75.0
Flow control additive (NAD)	54.1
Stabilizer CGL 079L solution	4.9

Stabilizer CGL 900 solution	19.8
p-Toluene sulfonic acid solution	3.3

The above formulation was reduced with butyl acetate to bring the viscosity to 30 sec. #4 Ford cup.

FORMULATION G

	wt. g
Tetrahydroxy oligomer **5**	62.5
Dihydroxy oligomer **6**	20.1
Cymel 301	26.3
Mill base	75.0
Flow control additive (NAD)	52.3
Stabilizer CGL 079L solution	4.7
Stabilizer CGL 900 solution	18.5
p-Toluene sulfonic acid solution	2.3
Butyl acetate	7.0

FORMULATION H

	wt. g
Dihydroxy oligomer **6**	26.9
Hydroxy acrylic polymer	94.1
Cymel 301	35.0
Mill base	100.0
Flow control additive (NAD)	69.6
Stabilizer CGL 079L solution	6.3
Stabilizer CGL 900 solution	31.9
p-Toluene sulfonic acid solution	3.1
Methyl amyl ketone	26.0

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Oxazolidone Coatings

Part I: Synthesis and Structure

P.I. Kordomenos
Ford Motor Company*

and

K.C. Frisch and J.E. Kresta
University of Detroit†

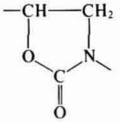
The catalysis of the oxazolidone-forming reaction was studied using isocyanate and epoxy functional model compounds employing different catalyst systems. It was found that the concentration of the NCO group decreased during the reaction faster than the concentration of the epoxy group. Several side reactions were investigated in order to explain this phenomenon. Oxazolidone ring-containing polymers such as polyoxazolidones, poly(oxazolidone-isocyanurates), poly(oxazolidone-epoxides), and poly(oxazolidone-urethane-isocyanurates) were prepared and characterized.

INTRODUCTION

The synthesis and properties of polyoxazolidones have attracted a great deal of attention in recent years because they are promising engineering materials for the manufacture of a wide variety of useful products including rigid foams, thermoplastics, coatings, adhesives, and elastomers.[1-6] These materials have been claimed to have excellent thermal insulating properties and heat stability.[7-10]

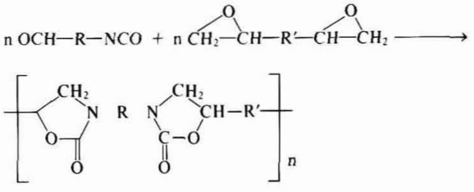
The first attempt to prepare poly-2-oxazolidone was carried out by K.A. Krasuskii,[11] whose efforts to prepare substituted 2-oxazolidones from 1,2-epoxides and isocyanates using basic catalysts (tertiary amines) led only to the polymerization of the isocyanate. The first successful synthetic method was developed by Speranza and Peppel,[12] who found that quaternary ammonium halides were efficient catalysts for the addition of isocyanates to 1,2-epoxides.

Generally, poly-2-oxazolidones are characterized by the five-membered ring:

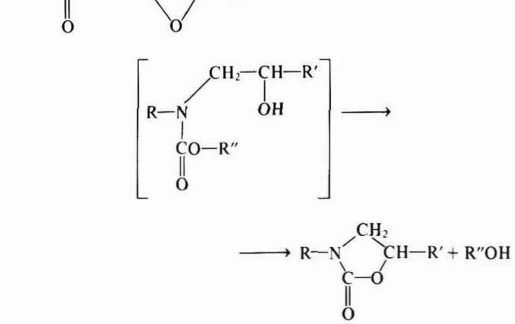


The formation of oxazolidone polymers can be carried out through six synthetic routes employing one or combinations of suitable catalysts:

(1.) Cycloaddition of isocyanates to expoxides:[7-10]



(2.) Intermolecular nucleophilic addition between urethane and epoxy groups:[13]



(3.) Intermolecular addition reaction between di- and tri-substituted ureas and epoxy compounds:

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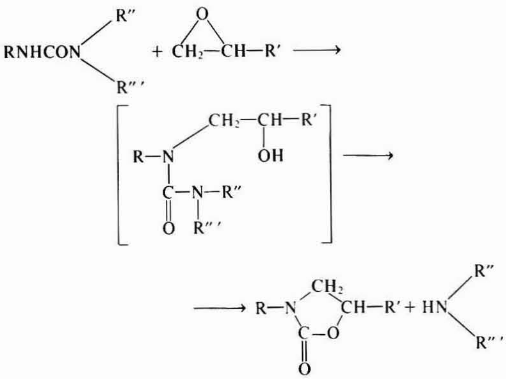
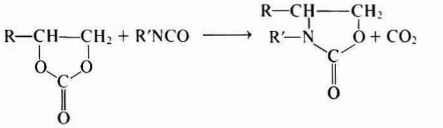
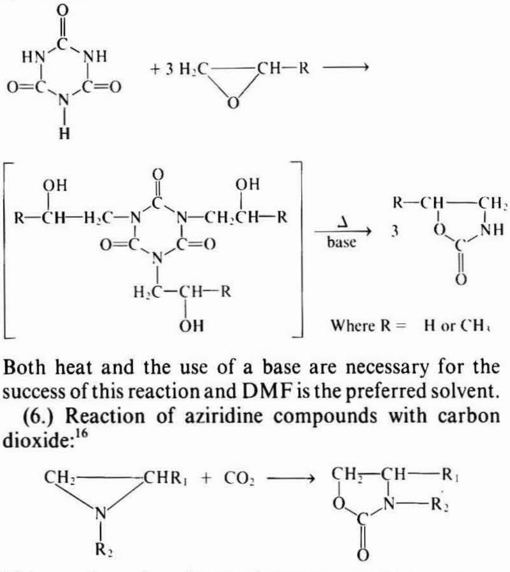
[*] PP&V Div., Paint Plant, Mt. Clemens, MI 48143.
[†] Polymer Institute, Detroit, MI 48221.



(4.) Cyclic addition of isocyanates to cyclic carbonates:[14]

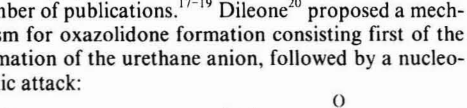


(5.) Reaction of cyanuric acid (s-triazinetrione) with epoxides:[15]



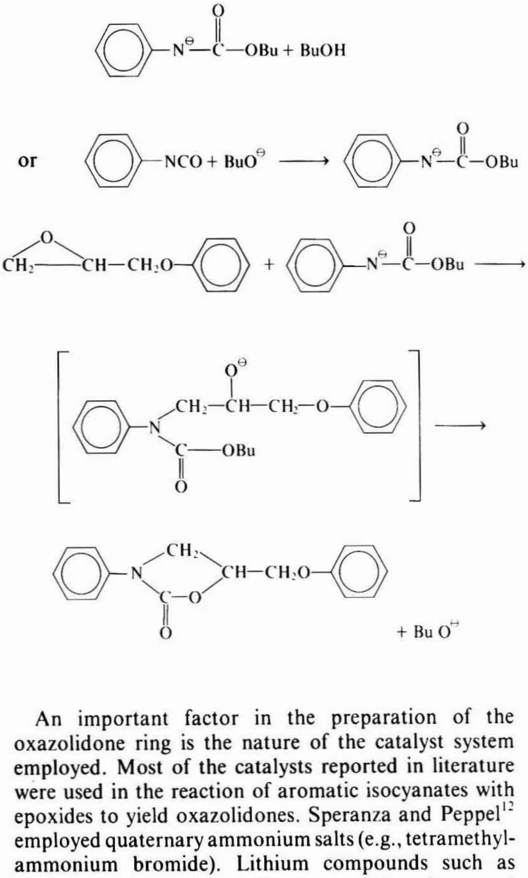
Both heat and the use of a base are necessary for the success of this reaction and DMF is the preferred solvent.

(6.) Reaction of aziridine compounds with carbon dioxide:[16]



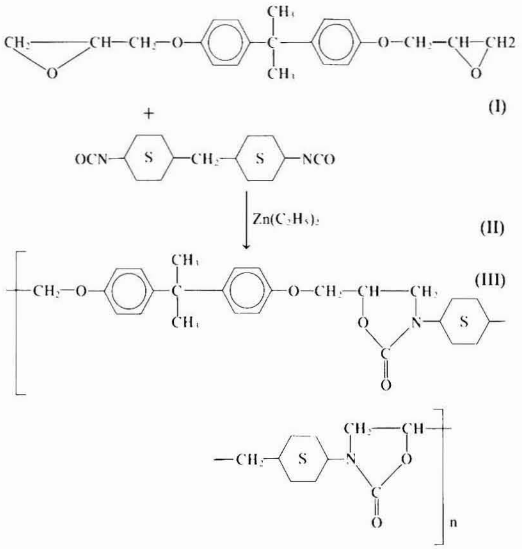
This reaction takes place under pressure at temperatures close to room temperature and in the presence of Lewis acids as catalysts.

The synthesis, characterization and properties of various polyoxazolidones have been described in a number of publications.[17-19] Dileone[20] proposed a mechanism for oxazolidone formation consisting first of the formation of the urethane anion, followed by a nucleophilic attack:



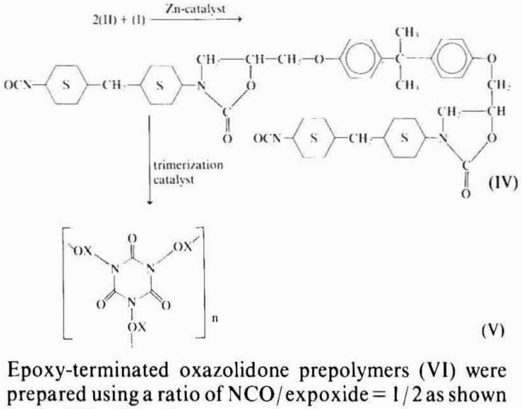
An important factor in the preparation of the oxazolidone ring is the nature of the catalyst system employed. Most of the catalysts reported in literature were used in the reaction of aromatic isocyanates with epoxides to yield oxazolidones. Speranza and Peppel[12] employed quaternary ammonium salts (e.g., tetramethylammonium bromide). Lithium compounds such as lithium chloride, with or without solvent, have been used by Gulbins, et al.[14] and by Herweh, et al.[8] A complex of LiBr and tributyl phosphine oxide has also been used quite effectively.[10] Complexes that were prepared from a Lewis acid such as $AlCl_3$, $AlBr_3$, AlI_3, LiCl, LiBr, and $FeCl_3$ and a Lewis base such as tetrahydrofuran, tetrahydropyran, n-butyl ether, n-butylamine, hexamethylphosphoric triamide, and tris(2-ethylhexyl)phosphine oxide, were used by Ashida[21] to prepare oxazolidone foams and oxazolidone isocyanurate foams. Kitayama, et al.[22] used a magnesium chloride-hexamethylphosphoric triamide complex in order to synthesize polyoxazolidone elastomers having low modulus and high tensile strength.

Relatively little information is available on the use of oxazolidone-containing polymers in coating applications. The objectives of this investigation were: (a) the evaluation of catalyst systems suitable for the formation of oxazolidones from both aromatic as well as aliphatic diisocyanates; and (b) the synthesis and structure properties relationships of oxazolidone containing polymers such as polyoxazolidones, poly(oxazolidone-isocyanurates), poly(oxazolidone-epoxides), and poly(oxazolidone-urethane-isocyanurates). Oxazolidone-containing polymers were prepared from the diglycidyl ether of bisphenol A (I) and 4,4-methylene bis(cyclohexyl isocyanate) (II). Zinc catalysts such as diethyl zinc were used and cellosolve acetate as solvent When the NCO/epoxide ratio was kept at 1/1, thermoplastic polyoxazolidones (III) were formed according to the following scheme:



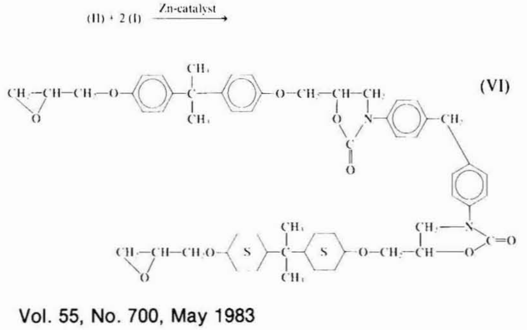
(I)
(II)
(III)

Using an NCO/epoxy ratio of 2/1, an NCO-terminated, oxazolidone-containing prepolymer (IV) was formed which was then trimerized to yield poly(oxazolidone-isocyanurates) (V) with the use of a trimerization catalyst as shown below:



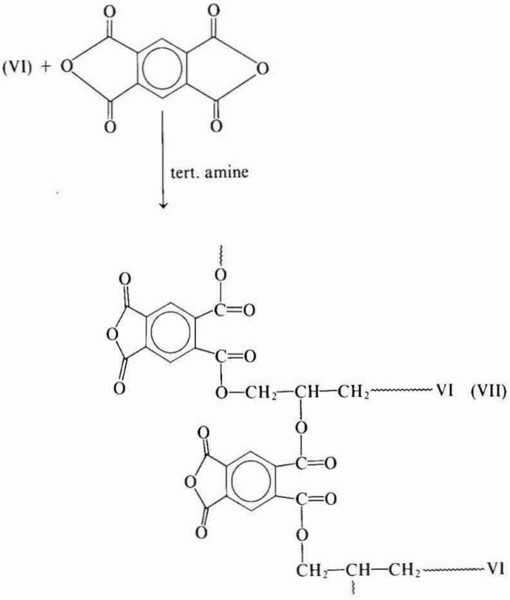
(IV)
(V)

Epoxy-terminated oxazolidone prepolymers (VI) were prepared using a ratio of NCO/expoxide = 1/2 as shown in the following scheme:



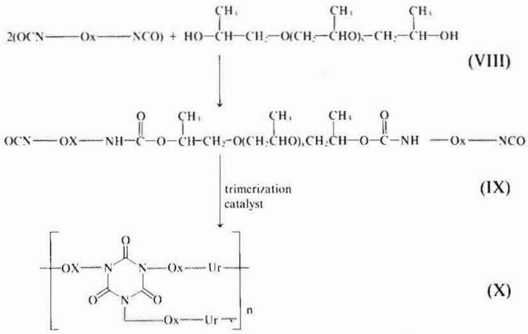
(VI)

The epoxy-terminated oxazolidone prepolymer (VI) could be cured with conventional epoxy hardeners or catalysts. The curing reaction with pyromellitic dianhydride (VII) in the presence of tertiary amine catalyst is schematically shown below:



(VII)

Poly(oxazolidone-urethane-isocyanurates) (XI) were prepared from isocyanurate-terminated oxazolidone prepolymers (IV) and poly(oxypropylene) glycols (VIII) of different chain lengths via the formation of NCO-terminated poly(oxazolidone-urethanes) (X) according to the following scheme:



(VIII)
(IX)
(X)

Where Ox = oxazolidone
and Ur = urethane

EXPERIMENTAL

Materials

The chemicals used in this study and their purity are listed in *Table* 1.

The monofunctional isocyanates were purified by means of vacuum distillation; the difunctional isocyanates were used as supplied by the manufacturers. Cellosolve acetate was refluxed with calcium hydride (2 g

Table 1—Materials

Designation	Chemical Identification	Supplier
MDI	4,4'-Methylene bis(phenyl isocyanate)	The Upjohn Co.
H_{12}MDI	4,4'-Methylene bis(cyclohexyl isocyanate)	Mobay Chemical Co.
Phenyl isocyanate		Aldrich Chemical Co.
Cyclohexyl isocyanate		Aldrich Chemical Co.
P-410	Poly(oxypropylene)glycol MW=400	BASF Wyandotte Corp.
P-710	Poly(oxypropylene)glycol MW=700	BASF Wyandotte Corp.
P-1010	Poly(oxypropylene)glycol MW-1000	BASF Wyandotte Corp.
DER-332	Diglycidyl ether of bisphenol A	Dow Chemical Co.
Phenyl glycidyl ether	3-Phenoxy-1,2-propylene oxide	Scientific Products
T-12	Dibutyltin dilaurate	M & T Chemical
DMP-30	Tris 2,4,6,(dimethylaminomethyl) phenol	Rohm and Haas Co.
Diethylzinc		Texas Alkyls
PMDA	Pyromellitic dianhydride	E.I. duPont de Nemours & Co.
Cellosolve acetate	2-Ethoxyethyl acetate	Union Carbide Corp.
DMF	Dimethyl formamide	Sargent-Welch
Calcium hydride		J. T. Baker Chemical Co.

per liter) and then distilled under nitrogen flow. Dimethyl formamide was dried over Linde 4A molecular sieves.

Preparation of Model Compounds

All the reactions for the preparation of model compounds were carried out in an apparatus that had been dried at 150° C for three hours. The apparatus was assembled under nitrogen which was previously passed through traps containing glass beads and phosphorus pentoxide.

5-PHENOXYMETHYL-3-PHENYL-2-OXAZOLIDONE (XII): Phenyl isocyanate (0.2 moles) and 3-phenoxy-1,2-propylene oxide (0.2 moles) were heated in 100 mL of cellosolve acetate with 0.5 mmoles of diethylzinc as catalyst. The reaction mixture was stirred at 150° C for 10 hours and then was poured into 600 mL of diethyl ether and kept at 0° C for 12 hours. The precipitate was filtered and washed several times with diethyl ether to yield 19.9 g (70.6% yield) of product. Purification was carried out by repeated recrystallizations from benzene and diethyl ether. The product had a M.P. of 135° C; IR: 1760 cm^{-1}; ν(C=0).

Anal. calcd. for $C_{16}H_{15}O_3N$: C, 71; H, 5.6; N, 5.2.
Found: C, 71.5; H, 5.6; N, 5.21.

5-PHENOXYMETHYL-3-CYCLOHEXYL-2-OXAZOLIDINONE (XIII): Cyclohexyl isocyanate (0.2 moles) and 3-phenoxy-1, 2-propylene oxide (0.2 moles) were heated in 100 mL of cellosolve acetate with 0.5 mmoles of diethylzinc as catalyst. The reaction mixture was stirred at 150° C for 10 hours to yield 14 g (50.9% yield) of product. Purification was carried out in the same manner as in the case of (I). The product had a M.P. of 137–138° C; IR: 1740 cm^{-1} ν(C=0).

Anal. calcd. for $C_{16}H_{21}O_3N$: C, 69.8; H, 7.7.
Found: C, 69.9; H, 7.9.

1,3,5,-TRIPHENYL-S-TRIAZINE-2,4,6 (1H,3H,5H)-TRIONE (XIV): Phenyl isocyanate (0.92 moles) was mixed with 100 mL of pure acetone in the presence of 0.5% (W/W based on isocyanate) trimerization catalyst [mixture of 20% solution of potassium acetate in ethylene glycol with tris-2,4,6(dimethylaminomethyl) phenol (DMP-30), ratio· $\frac{\text{DMP-30}}{\text{solution}} = 4/1$]. The mixture was stirred for five hours at 70° C and then poured into 600 mL of benzene. The precipitate was purified by repeated recrystallizations from acetone and benzene. The product had a M.P. of 281° C; IR; 1710 cm^{-1} ν(C=0).

Anal. calcd. for $C_{21}H_{15}O_3N_3$: C, 70.6; H, 4.2; N, 11.8.
Found: C, 71.1; H, 4.5; N, 11.8.

PREPARATION OF PHENYL ISOCYANATE DIMER: To a 300 mL three-necked flask were added 100 mL of phenyl isocyanate and 100 mL of pyridine (pyridine was dried and freshly distilled). The solution was stirred at room temperature for eight hours. The dimer was recrystallized from diethyl ether (M.P. = 175° C). (Ref. 23: M.P. 175° C). IR: 1780 cm^{-1} ν(C=0).

REACTION OF TRIPHENYL ISOCYANURATE WITH PHENYL GLYCIDYL ETHER: To a 250 mL three-necked flask was added 30.0 g (0.2 eq) of phenyl glycidyl ether, 23.82 g (0.2/3 eq) of triphenyl isocyanurate, 0.2% of Zn $(C_2H_5)_2$ and 50 mL of cellosolve acetate. The mixture was stirred at 150° C overnight. From the titration of the epoxide group it was obvious that no reaction had taken place.

REACTION OF PHENYL ISOCYANATE DIMER WITH PHENYL GLYCIDYL ETHER: To a 150 mL three-necked flask were added 11.91 g (0.05 eq) of phenyl isocyanate dimer, 7.5 g (0.05 eq) of phenyl glycidyl ether, 0.04 g of Zn $(C_2H_5)_2$ and 50 g of cellosolve acetate. The reaction mixture was kept under nitrogen at 150° C. The NCO and epoxide percentages were determined every hour. After six hours of reaction, the epoxide conversion reached 72.96%. The product was recrystallized from carbon tetrachloride and was proven to be oxazolidone by means of IR 1760 cm^{-1} ν(C=O) and melting point (M.P. = 135° C).[20]

REACTION OF 5-PHENOXYMETHYL-3-PHENYL-OXAZOLIDINE-2-ONE WITH PHENYL ISOCYANATE: To a 250 mL three-necked flask were added 26.93 g (0.1 eq) of 5-phenoxymethyl-3-phenyl-oxazolidine-2-one (prepared from phenyl isocyanate and phenyl glycidyl ether), 11.91 g (0.1 eq) phenyl isocyanate, 0.2% Zn $(C_2H_5)_2$ and 100 g of cellosolve acetate. The reaction mixture was kept under stirring at room temperature for two hours. Then the temperature was raised to 150° C and kept there for six hours. The NCO percentage was determined every hour (*Figure* 1). These measurements indicated that some type of reaction took place. After six hours 15.02 g (0.1 eq) of phenyl glycidyl ether were added and the NCO and epoxide percentages measured every hour.

The same reaction was run using 5-phenoxymethyl-3-cyclohexyl-oxazolidine-2-one and cyclohexyl isocyanate.

PREPARATION OF OXAZOLIDONE RING-CONTAINING POLYMERS AND COPOLYMERS PREPARATION OF EPOXY-TERMINATED POLYOXAZOLIDONE (POXEP): To a 300 mL three-necked flask, equipped with a nitrogen inlet, stirrer, reflux condenser and thermometer were added 0.5 moles of diglycidyl ether of bisphenol A, (DER-332), 0.25 moles of 4,4'-methylene bis(cyclohexyl isocyanate) ($H_{12}MDI$) and 62 mL of cellosolve acetate. The mixture was heated to 150°C and 0.5% W/W diethylzinc was added. The concentrations of the NCO and epoxide groups were measured periodically. The reaction was stopped when the conversion of the epoxide group reached 50%.

The epoxide-terminated prepolymer was cured using pyromellitic dianhydride (PMDA) as curing agent and tris-2,4,6(dimethylaminomethyl) phenol (DMP-30) as catalyst. The amount of PMDA used was calculated from the following formula:

$$\frac{\text{Eq. Wt. of PMDA} \cdot 100}{\text{Eq. Wt. of epoxy prepolymer}} = \%\ (\text{W/W}) \text{ of PMDA in epoxy prepolymer}$$

1% (W/W) of DMP-30 was used and films with a wet thickness of 8 mils were drawn on glass, aluminum, and steel plates. The films were cured at 150° C for five hours.

PREPARATION OF LINEAR POLYOXAZOLIDONE: To a 300 mL three-necked flask 0.5 moles of DER-332, 0.5 moles $H_{12}MDI$ and 79 mL of cellosolve acetate were added. The NCO and epoxide concentrations were measured periodically. The reaction was stopped after eight hours. Films with a wet thickness of 8 mils were drawn on glass, aluminum, and steel plates. The films were cured at 150° C for five hours.

PREPARATION OF POLY(OXAZOLIDONE-ISOCYANURATES): DER-332 and $H_{12}MDI$ were reacted at a ratio of NCO/epoxide = 2/1 using cellosolve acetate as solvent (50% W/W solution) and 0.5% (W/W) diethylzinc as catalyst. The reaction temperature was kept at 150° C and the reaction was stopped when the NCO conversion reached 50%. The NCO-terminated prepolymer was cured using 1% (W/W) DMP-30 as trimerization catalyst. 20% (W/W) of benzene was added in order to lower the viscosity and to insure proper mixing of the catalyst. Films with a wet thickness of 8 mils were drawn on glass, aluminum, and steel plates. The films were cured at 150° C for five hours.

PREPARATION OF POLY(OXAZOLIDONE-URETHANE-ISOCYANURATES): The following procedure was employed for the preparation of oxazolidone-modified urethane-isocyanurate coating systems:

First step: Preparation of prepolymer

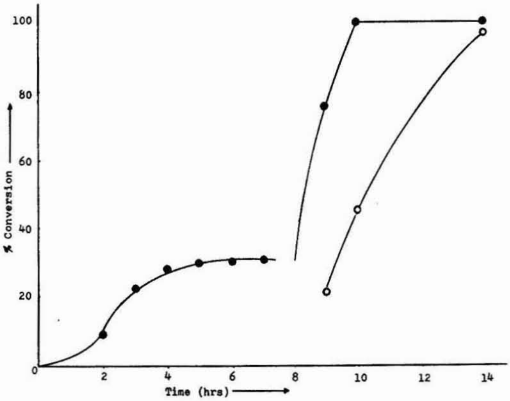


Figure 1—Reaction of 5-phenoxymethyl-3-phenyl-oxazolidine-2-one with phenyl isocyanate. ●=NCO conversion; ○=$-\underset{\diagdown O \diagup}{CH-CH_2}$ conversion

DER 332 + H_{12}MDI, $(\frac{\text{NCO}}{\text{epoxide}} = \frac{2}{1})$

Second step: Chain extension with poly(oxypropylene) glycols of 400, 700 and 1,000 mol. wts. (NCO/OH = 2/1)

Third step: Trimerization with DMP-30

The preparation of the isocyanate-terminated prepolymer was the same as described in the preparation of polyoxazolidone-isocyanates. The prepolymer was mixed with poly(oxypropylene) glycols of different molecular weights at a ratio of NCO/OH = 2/1. The mixture was heated to 80° C and 0.01% (W/W) of dibutyltin dilaurate was added. When the NCO conversion reached 50%, the reaction was stopped. The chain-extended prepolymer was dissolved in benzene 50% (W/W) solution and 0.5% (W/W) of DMP-30 was added. Films with a wet thickness of 8 mils were drawn on glass and steel plates. The films were cured at 150° C for five hours.

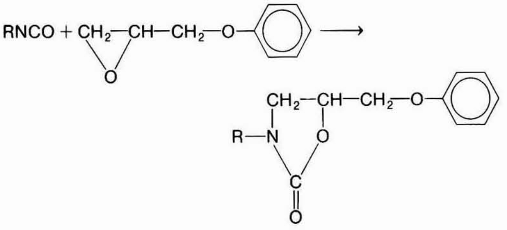
ANALYTICAL METHODS: The determination of the percent isocyanate group was carried out according to the method described in Ref. 23. The percent epoxide group was measured according to the method of Dijkstra and Dahmen.[24] The elemental analyses were carried out by Midwest Microlab, Ltd., Indianapolis, IN 46250.

RESULTS AND DISCUSSION

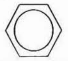
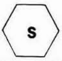
Model Studies

The catalytic activity of zinc alkyls in the oxazolidone forming reaction has previously been described.[11] In this study, a number of zinc compounds other than zinc alkyls were found to be active catalysts for aromatic and cycloaliphatic substituents. The results summarized in *Table* 2 showed that, in general, the yield obtained from the cycloaliphatic isocyanate was somewhat lower than the yield obtained from the aromatic isocyanate, with the exception of zinc acetylacetonate. The best yields were

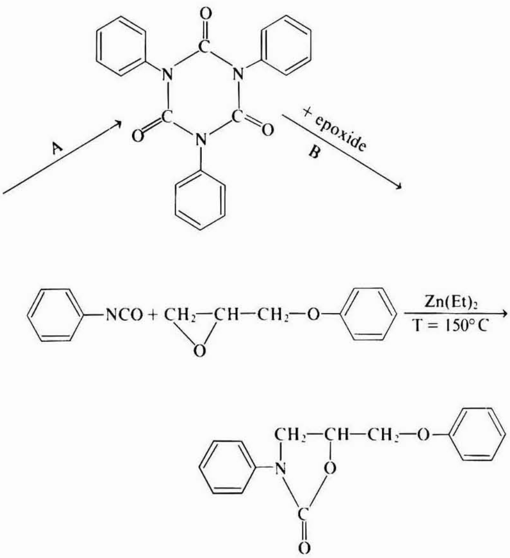
Table 2—Catalysis of Oxazolidone Forming Reaction



RNCO = 0.1 M
$C_6H_5OCH_2CHCH_2O$ = 0.1 M
Catalyst = 0.0005 M
Solvent = 100 ml 2-ethoxyethyl acetate
Temp. = 150°C, reaction time = 10 hrs

Catalyst	% Yield R = 	 R = 
None	0	0
Zinc octoate	40.8	29.1
Diethylzinc	70.6	50.9
Zinc acetylacetonate	26.0	47.3
Zinc chloride	55.4	48.7
Zinc bromide	76.6	57.2
Ferric chloride	7.4	10.9
Lithium chloride	85.5	21.8
Aluminum isopropoxide	1.8	0.7

obtained with $Zn(C_2H_5)_2$ and LiBr. The reactions between isocyanate and epoxy groups were studied on model systems based on phenyl isocyanate, cyclohexyl isocyanate, and phenyl glycidyl ether. The reactions were carried out at 150°C in cellosolve acetate at equimolar ratio of NCO/epoxy and the disappearance of the NCO and epoxy groups was determined at various time intervals. The results are summarized in *Figures* 2 and 3. It was found that the concentration of the NCO groups decreased during the reaction faster than the concentration of the epoxy groups. This phenomenon was observed with aromatic and cycloaliphatic isocyanates in closed (negligible evaporation of reactants), and in open reaction systems using various catalysts. This phenomenon could be explained by side reactions which took place during the formation of the oxazolidones. The possible side reactions are summarized as follows:



Formation of carbodimides

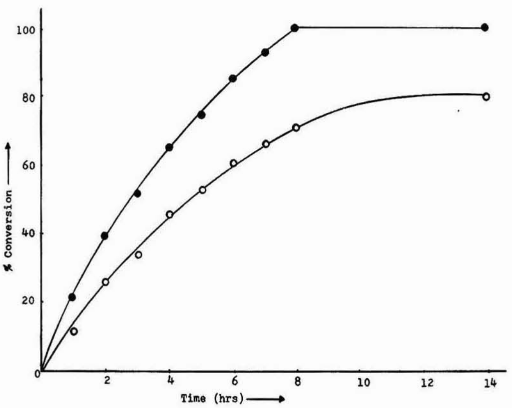


Figure 2—Reaction of phenyl isocyanate with phenyl glycidyl ether. ● = NCO conversion; O = —CH—CH₂ conversion (O)

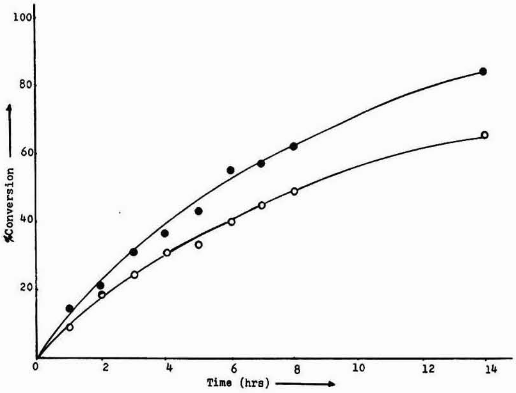


Figure 3—Reaction of cyclohexyl isocyanate with phenyl glycidyl ether. ● = NCO conversion; O = —CH CH₂ conversion (O)

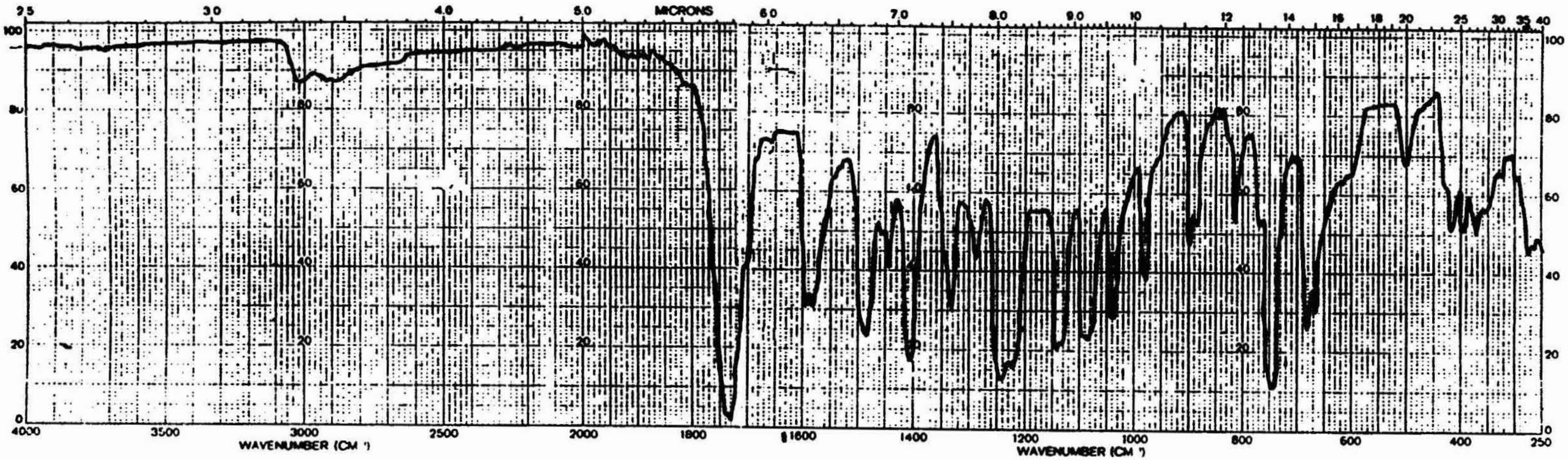


Figure 4—Infrared spectrum of the reaction product of phenyl isocyanate with phenyl glycidyl ether

Figure 5—Infrared spectrum of mixture of 5 parts of phenyl isocyanate dimer and 95 parts of 5-phenoxymethyl-3-phenyl-oxazolidine-2-one

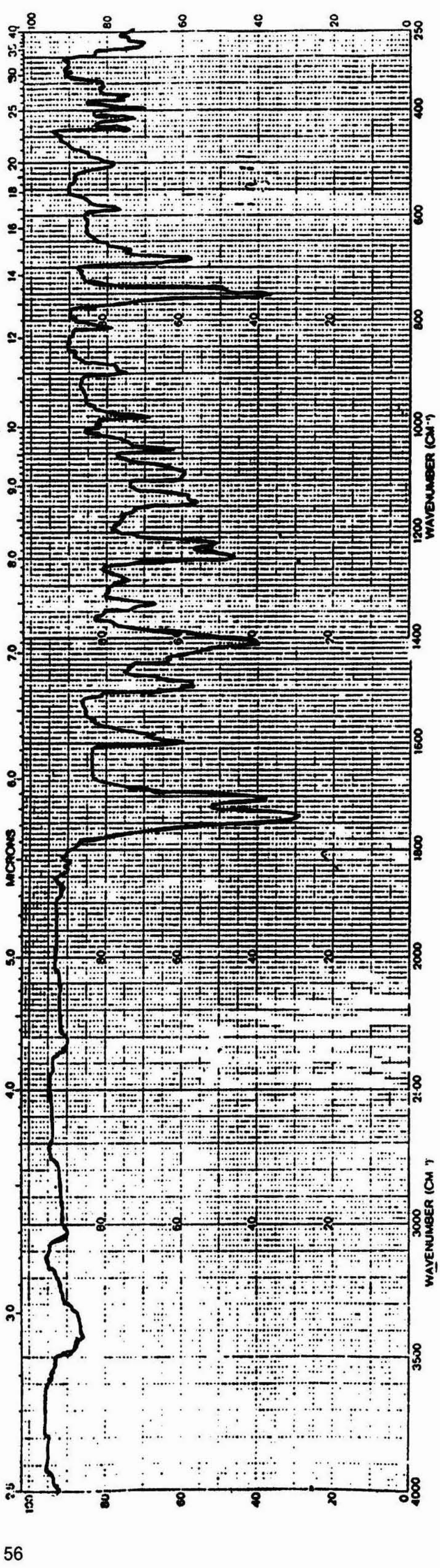
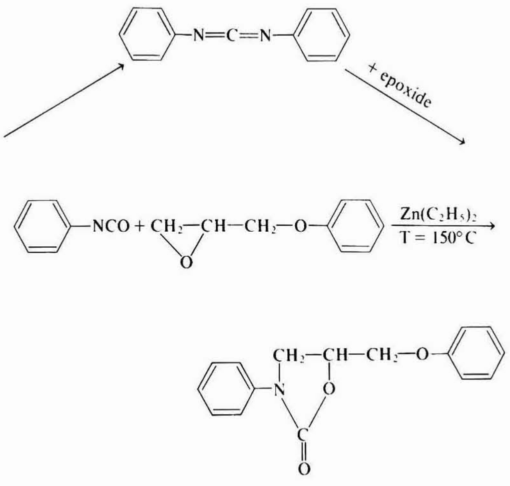
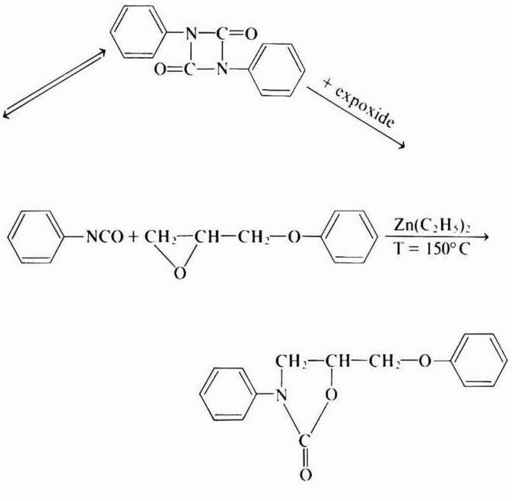


Figure 6—Infrared spectrum of mixture of 10 parts of phenyl isocyanurate and 90 parts of 5-phenoxymethyl-3-phenyl-oxazolidine-2-one



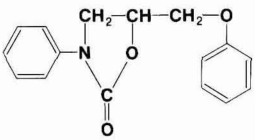
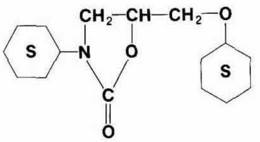
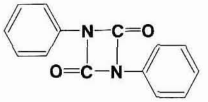
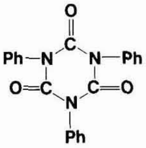
Formation of uretedine-diones (dimers)



Formation of unstable adduct of isocyanate with the oxazolidone ring

The close examination of by-products of the oxazolidone reaction by IR spectroscopy revealed that the formation of carbodiimides [ν(N=C=N) at 4.72μ] and dimer [ν(C=0) at 5.65μ] did not take place. In the case of trimer certain overlapping with the oxazolidone absorption peak did occur, but the experiments with mixtures of pure oxazolidone and trimer at exact weight proportion showed that the amount of trimer in the reaction mixture, if any, was very small (*Figures* 4–6). This conclusion is also supported by the solubility characteristics of these compounds. The solubility of trimer was very limited in

Table 3—Solubility Characteristics

Solvent				
Diethyl ether	IN	IN	IN	IN
Acetone	S^c	S^c	S^b	S^c
Benzene	S^c	S^b	S^b	IN
Toluene	S^c	S^c	S^c	S^b
Chloroform	S^c	S^c	S^c	S^c
Acrylonitrile	S^c	S^c	S^b	S^c
Tetrahydrofuran	S^c	S^c	S^c	S^c
Chlorobenzene	S^c	S^c	S^c	S^b
2-Ethoxyethyl acetate	S^c	S^c	S^b	S^c
Dimethyl formamide	S^c	S^c	S^c	S^c
Carbon tetrachloride	S^b	S^a	IN	IN

IN = insoluble.
(a) = soluble 1-2% w/v.
(b) = soluble 5% w/v.
(c) = soluble 10% or more w/v.

the solvent system used in these reactions (*Table* 3) and for this reason any significant amount formed should result in the formation of a precipitate. Such a precipitate was not observed in any of the oxazolidone-forming reactions. It was determined that dimer could react with epoxy in the presence of diethylzinc and form oxazolidone. However, under the same conditions trimer did not react. It was also observed that the model oxazolidone reacted at 150° C with phenyl isocyanate or cyclohexyl isocyanate in the presence of diethylzinc (*Figure* 1). According to this data, the faster disappearance of the isocyanate in the oxazolidone forming reaction can be explained possibly by the formation of an adduct between the NCO and oxazolidone ring.

The properties of oxazolidone based polymers will be discussed in the second part of this paper.[25]

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Test yourself. Find out how much you know about first aid, accident prevention, reducing your risk of heart disease and home nursing skills. This is not a pass or fail test. Its purpose is to tell you how well you're doing in maintaining good health.

1 What should you do to control bleeding from a wound?

a Apply pressure directly over the wound.
b Run cold water over the wound.
c Apply a tourniquet.

2 What is the most effective way to begin changing a personal risk factor for heart disease?

a Don't worry about it.
b Set a deadline date for change.
c Identify the situations and conditions which influence the behavior(s) you wish to change.
d Work harder at developing willpower.

3 The best place to check the pulse in an emergency is at the:

a Upper arm.
b Neck.
c Wrist.
d Thigh.

4 Which heat burns may be cooled in water?

a Thin burns that are not open.
b Deep burns that are open.
c All heat burns.
d No heat burns.

5 You should wait at least 10 minutes before taking the temperature if the person has been:

a Running.
b Smoking.
c Drinking coffee.
d Eating ice cream.
e All of the above.

6 Overweight individuals are at greater risk for:

a Diabetes.
b Gall bladder disease.
c High blood pressure.
d All of the above.

7 What are the most common symptoms of high blood pressure?

a Dizziness.
b Headaches.
c Heart palpitations.
d No symptoms, usually.

8 How can you tell if your blood pressure is up or down?

a By how you feel, physically.
b By your emotions.
c By your pulse rate.
d By having it checked regularly.

9 After an accident, there is no sign of blood. The victim has cold, moist skin and feels pain and tenderness in the abdomen. The victim probably has:

a Pulmonary arrest.
b An infection.
c An internal injury.
d Cardiac arrest.

10 Which of the following nutritional statements is *not* correct?

a Eggs are a good source of protein.
b Vitamin D helps build strong bones and teeth.
c Vitamin C maintains muscle tone.
d Good sources of vitamin A are green and yellow vegetables.

ANSWERS:

(1)*a* (2)*c* (3)*b* (4)*a* (5)*e*
(6)*d* (7)*d* (8)*d* (9)*c* (10)*c*

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Oxazolidone Coatings

Part II: Structure-Properties Relationships And Thermal Stability

P.I. Kordomenos
Ford Motor Company*

and

K.C. Frisch and J.E. Kresta
University of Detroit†

The structure-properties relationships of oxazolidone ring-containing polymers including polyoxazolidones, poly(oxazolidone-isocyanurates), poly (oxazolidone-epoxides), and poly(oxazolidone-urethane-isocyanurates) were investigated. It was found that the thermal stability of these polymers, as determined by TGA, increased with increasing concentration of the oxazolidone rings and increasing crosslink density. The hardness, stress-strain properties, and solvent resistance of the oxazolidone-containing polymers without the urethane linkages were very good, while the Gardner impact resistance was only moderate to low. The introduction of urethane linkages in these polymers significantly improved the impact resistance but somewhat decreased the thermal stability depending upon the chain length of the polyether diol used.

INTRODUCTION

The structure-properties relationship and the thermal stability of oxazolidone coatings (polyoxazolidones, poly [oxazolidone-isocyanurates], poly [oxazolidone-epoxides], and poly[oxazolidone-urethane-isocyanurates]) prepared according to the procedures described in the previous paper[1] (Part I) were studied and the results are discussed in this paper.

EXPERIMENTAL

Determination of the Physical Properties

The hardness of polymer films was measured using a Sward Hardness Rocker. The stress-strain properties of polymer films were measured using a Universal Instron Tester (Table Model 1130). Generally, the ASTM D638-68 procedure was followed. At least 10 measurements were taken for each sample and the average value was used as the value of the ultimate tensile strength and elongation at breaking point. The impact resistance was measured in terms of work required in foot-pounds to cause film rupture. A Gardner Impact Tester was used for all direct and indirect measurements.

Thermal Stability of Oxazolidone Polymers

The thermal degradation of model polymers was studied by means of thermogravimetric analysis (TGA). The thermogravimetric studies were conducted using a DuPont 900 thermobalance. The dynamic TGA curves were obtained at the linear heating rate of 15° C per min. The accuracy of the temperature reading was ± 1° C. The sample weight was 10-12 mg. The isothermal TGA measurements were obtained at different temperatures at a time-axis scale of 10 min/in. and 20 min/in.

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* PP&V Div., Paint Plant, Mt. Clemens, MI 48143.
† Polymer Institute, Detroit, MI 48221

Table 1—Properties of Oxazolidone-Ring Containing Polymers
(H_{12}MDI + DER332)

	NCO/Epoxide Ratio		
Properties	**1:2 (POXEP)**	**1:1 (POX)**	**2:1 (POXTR)**
Sward hardness	42	28	52
Gardner impact: lb/in.:			
Direct	40	30	50
Reverse	30	20	40
Solvent resistance[a]	Excellent	Excellent	Excellent
Tensile strength: psi	7727	11010	8232
Elongation %	4	3	7

(a) In acetone, benzene, toluene.

RESULTS AND DISCUSSION

Properties of Oxazolidone-Ring Containing Polymers

Thermoplastic polyoxazolidones (POX) were prepared from 4,4′-methylene bis(cyclohexyl isocyanate) and diglycidyl ether of bisphenol-A. Diethyl zinc was used as catalyst and cellosolve acetate as solvent. The formation of the oxazolidone ring was confirmed by both infrared spectra (oxazolidone carbonyl at 1740 cm^{-1}) and conversion of the NCO and epoxide groups.

Polyoxazolidone-isocyanurate (POXTR) was prepared from the same epoxy and isocyanate components using an excess of the diisocyanate (NCO/epoxide = 2/1). The NCO-terminated prepolymer was cured using tris-2,4,6(dimethylaminomethyl) phenol (DMP-30) as trimerization catalyst. Epoxy-terminated polyoxazolidone (POXEP) was prepared using a ratio of NCO/epoxide = 1/2. The epoxy-terminated prepolymers had certain advantages in comparison with the corresponding NCO-terminated prepolymers. They could be stored for several weeks without any apparent change in the epoxy equivalent (in the case of the NCO-terminated prepolymers, stabilizers are usually required).

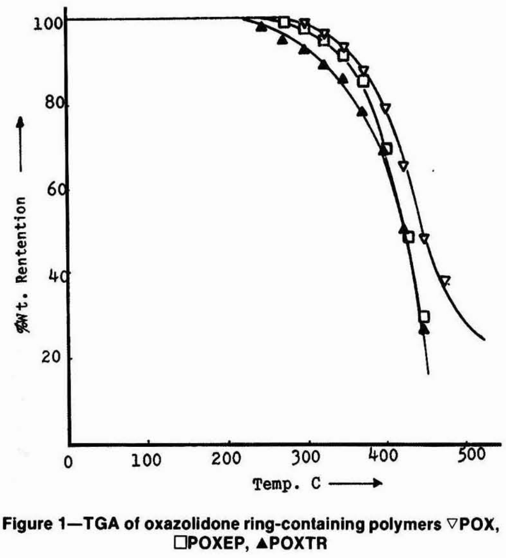

Figure 1—TGA of oxazolidone ring-containing polymers ▽POX, □POXEP, ▲POXTR

The curing of the polyoxazolidone-epoxides took place using pyromellitic dianhydride in combination with DMP-30 catalyst. The bulk mechanical properties of films prepared from the above mentioned oxazolidone-containing prepolymers are shown in *Table* 1. The crosslinked coatings (POXEP) and (POXTR) exhibited high hardness, good tensile strength, and excellent

Table 2—Properties of Poly(Oxazolidone-Urethane Isocyanurates)

P1010
(H_{12}MDI + DER332) + P710
P410

Properties	**P410**	**P710**	**P1010**
Sward hardness	66	54	36
Gardner impact: lb/in.:			
Direct	90	160	160
Reverse	80	160	160
Solvent resistance[a]	Excellent	Excellent	Excellent
Tensile strength: psi	13372	8037	4295
Elongation %	5	7	19

(a) In acetone, benzene, toluene.

Table 3—Properties of Poly(Oxazolidone-Urethane Isocyanurates)

P1010
(MDI + DER332) + P710
P410

Properties	**P410**	**P710**	**P1010**
Sward hardness	50	24	14
Gardner impact: lb/in.:			
Direct	40	> 160	> [illegible]
Reverse	40	> 160	> 160
Solvent resistance[a]	Excellent	Excellent	Excellent
Tensile strength: psi	9000	5280	2933
Elongation %	10	50	60

(a) In acetone, benzene, toluene.

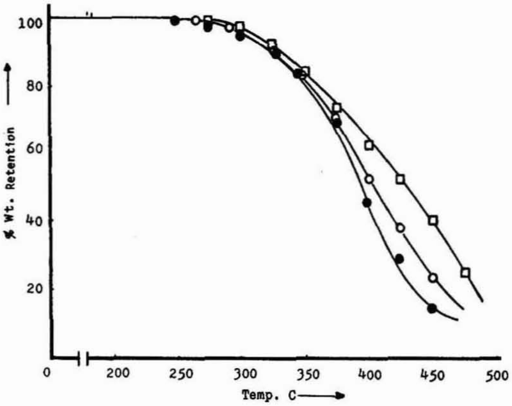

Figure 2—TGA of poly(oxazolidone-urethane-isocyanurates) (H_{12}MDI-based), chain extender: □P410, ○P710, ●P1010

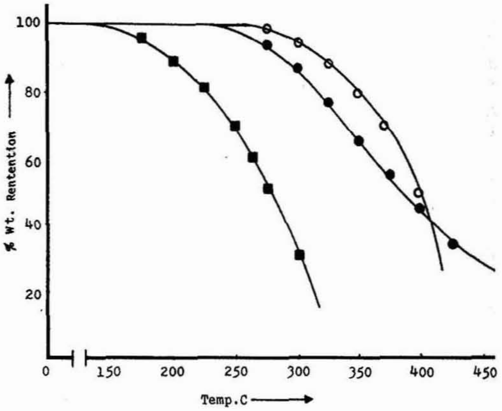

Figure 4—TGA of poly(oxazolidone-urethane-isocyanurates) (MDI-based), chain extender: ○P410, ●P710, ■P1010

solvent resistance but showed rather moderate impact resistance. The thermoplastic coating (POX) had lower hardness, tensile strength, and excellent solvent resistance but rather low impact resistance. The thermal behavior of the polyoxazolidone copolymers was examined by means of TGA. The results are shown in *Figure* 1.

In order to improve the relative brittleness of the coatings shown in *Table* 1, poly(oxypropylene) diols of different chain lengths (M.W. 400, 700, and 1,000) were reacted with NCO-terminated oxazolidone prepolymers prior to trimerization resulting in the formation of poly(oxazolidone-urethane-isocyanurates). Poly(oxazolidone-urethane-isocyanurates) were synthesized using both cycloaliphatic (H_{12}MDI) and aromatic (MDI) isocyanates and the same epoxy resin and polyether diols of M.W. 400, 700, and 1000 to impart some flexibility to these polymer systems. The bulk mechanical properties of the poly(oxazolidone-urethane-isocyanurates) are shown in *Tables* 2 and 3. The films extended with poly(oxypropylene) glycol of MW = 1,000 and MW = 700 were very flexible. Their impact resistance was over 160 lb/in. The films extended with poly(oxypropylene) glycol of MW = 400 were harder and less flexible.

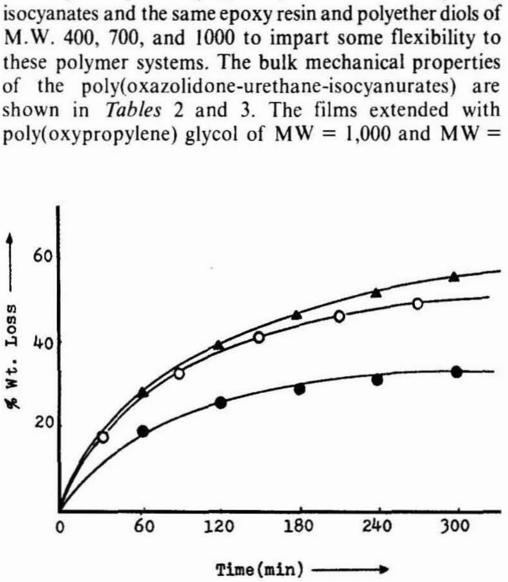

Figure 3—Isothermal TGA of poly(oxazolidone-urethane-isocyanurates) (H_{12}MDI-based), chain extender: ●P410, ○P710, ▲P1010; Temp: 280° C

The results of the thermogravimetric analysis of poly(oxazolidone-urethane-isocyanurate) are shown in *Figures* 2 and 3. Both dynamic and isothermal TGA showed that the thermal stability of the above copolymers increased with decreasing molecular weight of the poly(oxypropylene) glycol. As in the case of the cycloaliphatic diisocyanates, the films that were chain extended with P-410 diol were harder and less flexible. As the length of the polyether segment decreased, i.e., the crosslink density of the polymers increased, the hardness and tensile strength increased while the elongation decreased. There was a significant improvement in impact resistance of these films, especially the ones containing the longer polyether segments.

The results of the thermogravimetric analysis of poly(oxazolidone-urethane-isocyanurates) from MDI are shown in *Figure* 4. The MDI based polymers showed the same trend as the H_{12}MDI based polymers. Their thermal stability increased with decreasing molecular weight of the chain extending diol. According to this data, the general conclusion that can be drawn is that the thermal stability of these compositions increased with increasing concentration of the oxazolidone rings and increasing crosslink density. While the same trends in physical properties were evident for both the cycloaliphatic and aromatic diisocyanate based poly(oxazolidone-urethane-isocyanurates), there were apparent differences in the properties between these two types of systems.

References

(1) Kordomenos, P.I., Frisch, K.C., and Kresta, J.E., "Oxazolidone Coatings. Part I: Synthesis and Structure," JOURNAL OF COATINGS TECHNOLOGY, *55*, No. 700, 49 (1983).

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January 1983 Subcommittee Reports Of ASTM Committee D-1

The January 1983 meeting of ASTM Committee D-1 on Paint and Related Coatings and Materials was held on January 23-27 at the Americana Dutch Resort Inn, Buena Vista, Florida. In the four and one-half days preceding the final report session and general meeting of Committee D-1, approximately 180 members and guests met in 144 scheduled meetings of D-1 subcommittees and working groups, including one full day of a joint symposium with the Steel Structures Painting Council. The present membership of Committee D-1 is 497.

Special highlights of the meeting were the presentation of the Henry A. Gardner Award to Hiro Fujimoto, the announcement that Mark P. Morse would be a 1983 recipient of the Society Award of Merit, and the awarding of Certificates of Appreciation to 24 D-1 members.

The joint symposium with SSPC on the subject, "New Concepts for Coating Protection of Steel Structures," covering fourteen topics, was co-chaired by D. M. Berger and R. F. Wint.

Subcommittee Officer appointment was made: Sub. D01.33 on Varnish and Resins—C.M. Winchester to replace A.B. Juby as Secretary.

Highlights

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

Halohydrocarbons in Coatings—G.C. procedure proposed by the EPA was reworked by Sub. D01.21.55 and now shows promising results.

VOC Determinations—Sub. D01.21.56 has developed precision statements on all individual methods used to calculate VOC. A new round-robin will check two proposed methods for percent water by G.C.

Electrical Properties of Liquid Coatings—Sub. D01.24.26 is writing a method for an alternating current volume resistivity test for liquid coatings, which will be important to any activity regarding electrostatic spraying and transfer efficiency.

Color Standards Practice—Proposed practice for selection, preparation, and maintenance of color standards will be written by Sub. D01.26.02 and distributed to Sub. D01.26 members before the next meeting in June.

"Scab" Corrosion—Sub. D01.27.09 will continue work on development of an accelerated test. A display of various cycles will be shown at the June meeting. This is of particular interest to the automotive industry.

Latex Paint Purchasing Guide—GSA has agreed to start an investigation of purchasing latex interior flat paint using the State of Virginia's "weighted cost of active ingredients" method.

Surface Profile Measurement—Sub. D01.46.02 is seeking guidance on the proper use of various devices suitable for surface profile measurement in the field.

Pull-Off Adhesion—Round-robin test series is planned by Sub. D01.46.04 to check precision and accuracy of Elcometer testers for this purpose.

Future Meetings

June 26-29, 1983—Nashville, Tennessee (Hyatt Regency)
December 11-14, 1983—Bal Harbour, Florida (Sheraton)
May 20-23, 1984—Montreal, Canada

New standards since the June, 1982, meetings of D-1 in Society ballots in the months:

September, 1982

D 4206-, Test for Sustained Burning of Liquid Mixtures by the Setaflash Tester (Open Cup)

D 4207-, Test for Sustained Burning of Low-Viscosity Liquid Mixtures by the Wick Test

October, 1982

D 4209, Practice for Determining Volatile and Nonvolatile Content of Cellulosics, Emulsions, Resin Solutions, Shellac, and Varnishes

D 4212, Test for Viscosity by Dip-Type Viscosity Cups

D 4213, Test for Wet Abrasion Resistance of Interior Paints by Weight Loss

D 4214, Evaluating Degree of Chalking of Exterior Paint Films

February, 1983

D 4145-, Test Method for Coating Flexibility of Prepainted Sheet

D 4236-, Practice for Labeling Art Materials for Chronic Health Hazards

DIVISION 1
ADMINISTRATIVE

SUBCOMMITTEE D01.05 INTERCOMMITTEE RELATIONS

J. C. Weaver, Chairman

Committee D-33 on Protective Coating and Lining Work for Power Generation Facilities has accomplished much since its 1979 reformation from Sub. D01.43 and its 1972 inception as Sub. D01.46.07. There follows a list of its standards adopted by the society or still in process in D-33:

D3842-80 Guide for Selection of Tests for Coatings Used in Light-Water Nuclear Power Plants.

D3843-80 Practice for Quality Assurance for Protective Coatings Applied to Nuclear Facilities.

D3911-80 Method for Evaluating Coatings Used in Light-Water Nuclear Power Plants at Simulated Loss of Coolant Accident (LOCA) Conditions.

D3912-80 Test Method for Chemical Resistance of Coatings Used in Light-Water Nuclear Power Plants.

D4082-82 Method for the Determination of the Affect of Radiation on Coatings Used in Light-Water Nuclear Power Plants.

D4121-82 Practice for Photographic Documentation of Coating and Lining Failures and Defects.

D4138-82 Standard Method of Measurement of Dry Film Thickness of Protective Coatings by Destructive Means.

D4227-83 (?) Practice for Qualification of Journeymen Painters for Application of Coatings to Steel Surfaces of Safety-Related Areas in Nuclear Power Plants.

D4228-83 (?) Practice for Qualification of Journeymen Painters for Application of Coatings to Concrete Surfaces of Safety-Related Areas in Nuclear Power Plants.

D4256- May,'83 Society ballot on Method for Determination of the Decontaminability of Coatings Used in Light-Water Nuclear Power Plants.

D4257- May, '83 Society ballot on Practice for Design and Use of Safety Alert System for Hazardous Work Locations in the Coatings and Lining Industry.

Additional proposed standard practices ready but not yet scheduled for society ballot and which relate to surface preparation for use in light-water nuclear power plants are, in abridged titles:

D-xxxx Surface cleaning of concrete for coating.

D-xxxx Abrading surfaces of concrete for coating.

D-xxxx Acid etching surfaces of concrete for coating.

D-xxxx Cleaning concrete block for coating.

D-xxxx Determining the pH of chemically cleaned or etched concrete.

D-xxxx Indicating moisture in concrete for coating.

Other specific proposed standards under active development include: (1) qualification of inspection personnel; (2) indicating oil or water in compressed air; (3) repairability of coatings; (4) sample preparation for coatings; (5) acceptance of coatings defects; (6) graded quality assurance systems; (7) photographic adjuncts on coatings defects; and (8) coating contractor qualifications.

A "Manual on Protective Linings for Flue Gas Desulfurization Systems" is in preparation. These and other matters will be carried forward at the D-33 meetings on May 9–11 in the Hyatt Regency Hotel in Louisville, KY.

SUBCOMMITTEE D01.07 GOVERNMENT CONTACTS

A. A. Chasan, Chairman

It was announced that Federal Standard 141, which had recently been revised by the Federal Supply Service of GSA, had been returned to the Army Chemical Laboratory at Fort Belvoir for continued surveillance.

Federal Standard 595, Colors, will remain with the GSA, after an attempt by ASTM to have this Standard technically administered through private industry. This move is to be deplored, since the technical expertise in GSA, as a result of laboratory closings, to monitor continued uniformity of color cards, is clearly lacking.

In an administrative move the Federal Supply Service of the GSA was renamed the Office of Federal Supply and Service and the functions of paint standardization moved to Auburn, Wash.

The paint and adhesives quality control laboratory of the GSA in Region 9, San Francisco, continues to function for the time being, but may be phased out without warning.

Most of the OEM materials, controlled through QPL's, in recent years administered through the GSA, were returned to the Army at Fort Belvoir, but implementation is questioned due to lack of personnel.

SUBCOMMITTEE D01.15 LECTURES & SYMPOSIA

H. A. Wray, Chairman

Suggestions were made for a "company management" day. One of the features will be a talk by Mr. Jack McAndrews, of the F & F Dept. of the E. I. Dupont de Nemours and Co. Other top management people from the coatings industry will be invited to attend for a full day's activities.

Thanks were extended to Dean Berger and Rufus Wint for the planning and bringing to a successful conclusion the symposium on "New Concepts for Coating Protection of Steel Structures" and also to John Keane and the Steel Structures Painting Council for their excellent cooperation.

DIVISION 20
RESEARCH AND GENERAL METHODS

SUBCOMMITTEE D01.20 SAMPLING AND STATISTICS

H. E. Ashton, Chairman

The results of the survey on terminology regarding within and between laboratories were discussed and it was agreed to adopt "within-laboratory" and "among-laboratories." The revision of D 3980, "Interlaboratory Testing of Paint and Related Materials," is now ready for Society ballot.

During this review it was noted that the use of the terms "runs" and "replicates" was unsatisfactory. The chairman will attempt to devise more acceptable terms and ballot them to the subcommittee.

SUBCOMMITTEE D01.21 CHEMICAL ANALYSIS OF PAINT AND PAINT PRODUCTS

R. W. Scott, Chairman

Group 13, Coordination of VOC Standards, J. C. Weaver, Chairman. It was the hope of this task group to review the EPA's generated data on VOC, plus those obtained on other coating products resulting from Sub. D01.21.56's round-robin data from its review of D 3960, "Calculation of VOC," with EPA's representatives Dennis Crumpler and Robert Zehr. However, although expected, these individuals failed to attend the meeting. This matter will be pursued by Sub. D01.21.56 with hopes of finding out why the EPA questions the validity of ASTM test methods to determine VOC in coatings, namely D 2369-81, Method B and water by both G.C. and Karl Fisher methods. This will be done by letter and if this is satisfactory, a meeting with the EPA will be scheduled prior to the June D-1 meeting.

The task group consensus is to retain D 2369 as is and to determine its limitations, rather than to modify it based on yet unknown complaints to the EPA.

A transfer efficiency test has been developed by the EPA and industry. After undergoing test validation, the test method may be offered for ASTM adoption.

Group 26, Revision of D2697, "Volume Non-volatile Matter in Clear or Pigmented Coatings," M. Sites, Chairman, agreed to adopt a proposed technical change regarding the use of specific gravity instead of density. It was pointed out that to get volume from weight it is necessary to divide by density, not by specific gravity, which is dimensionless.

Group 47 on "Chemical Analysis of Calcium Boro Silicate" was formed, and will be chaired by J. Austin, of Halox Pigments.

Group 55, Halohydrocarbons in Coatings, C. Niemi, Chairman, reported that the initial testing to "debug" the G.C. method proposed by the EPA and which had been drafted in ASTM style, showed interferences and reproducibility problems. G.C. experts have reworked the procedure, recommending a different column, column packing, and procedural changes, including a switch from volume to weight percent determination. Results to date from two laboratories show accurate, reproducible results on three of four coatings tested. Results on the fourth coating agree, but are lower than expected. The remainder of the round-robin will be conducted as soon as possible.

Group 56, Review of D 3960, "Calculation of VOC," M. E. Sites, Chairman, reviewed the results of the first round-robin conducted to obtain precision statements for the method. Precision statements were obtained on all the individual methods used to calculate VOC, including D 1475 (density), D 2369 B (nonvolatile), and two methods for water %, D 3792 (G.C.) and D 4017 (Karl Fisher). VOC for solvent-reducible coatings showed a reproducibility number of 5.92%. Water-reducibles showed 71.21% (Karl Fisher) and 87.45% (G.C.). VOC for all the coatings in the round-robin showed a reproducibility number of 51.21%.

Discussion resulted in the following plan of action:

(1) The revision of D 3960 will include references to D 2832, "Standard Practice for Non-Volatile Content of Paint and Paint Materials," D 4140, "Practice for Non-Volatile Content of Driers," D 4139, "Practice for Non-Volatile Content of Pigments," and D 4209, "Practice for Non-Volatile Content of Celluloses, Shellac and Varnish."

(2) VOC for water-reducible coatings will be calculated as grams of VOC (not including water) per liter of paint (instead of liter of paint minus water). A precision statement will be generated using these values.

(3) A letter will be written to the EPA with all new data and precision statements, including recalculated VOC for water-reducibles and a meeting will be requested between EPA and ASTM personnel on these latest results.

(4) H. Fujimoto, of Inmont, will write up his method for percent water by G.C. (includes column conditioning, which is very important) and J. Benga, of PPG, will write up their method for percent water by G.C. These methods and two new water-reducible coatings will be supplied to the collaborators for a round-robin on percent water by G.C. and Karl Fisher.

Group 71, Revision of D 3335, "Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy," H. D. Swafford, Chairman, has completed its review of an alternate sample preparation procedure. The new procedure was not acceptable from a statistical standpoint. A note will be placed in the standard stating that information concerning this will be available at ASTM headquarters.

SUBCOMMITTEE D01.22 HEALTH AND SAFETY

H. A. Wray, Chairman

A significance and end-use statement was approved for D 1310, "Flash Point and Fire Point of Liquids by the Tag Open Cup Apparatus." It will be added under section 2.1 of the document.

Fourteen objections and/or comments, received from D. J. Lewis, of the United Kingdom, after the ballot closing date, were reviewed and treated as constructive comments. He has been advised in writing of the disposition of these comments. Comments and suggestions by H. E. Ashton were adopted.

It was reported that D 3278, "Flash Point of Liquids by the Setaflash Closed Tester," is in need of a significance statement and that a round-robin on various materials should be run.

H. E. Ashton suggested that a change in name should be made to D 3934 "Flash/No Flash Equilibrium Method," to avoid certain misunderstandings with other flash point methods. He will suggest a name to consider. Comments from D. J. Lewis on this method were discussed and, in the most part, adopted.

Lewis's recommendations on D 3941, "Test Method for Finite Closed Cup Flash Point of Liquids by the Equilibrium Method," were also discussed in detail. It was agreed to consider them for the next revision of the document.

D 4206 and D 4207, "Sustained Burning Tests," will be published in the near future. The U.S. Department of Transportation will be encouraged to review these methods for adoption.

The chairman reported on the activities of the Coordinating Committee of Flash Points.... (CCFP) as follows: (1) D. J. Lewis is preparing a manual, or all-inclusive guide, on Flash Point Technology. Mary Williams, of the U. S. Coast Guard, is editing the first rough draft. This manual will be of service to both industry and governmental regulatory agencies. (2) The CCFP has expanded its scope to include flash point considerations of oxidizers, peroxides, and evaluation of the definition of a "solid material" as proposed by the U.S. Department of Transportation.

SUBCOMMITTEE D01.23 PHYSICAL PROPERTIES OF APPLIED PAINT FILMS

M. P. Morse, Chairman

Group 10, Adhesion, H. E. Ashton, Chairman, reported that D 3359, "Adhesion by the Tape Test," passed D-1 balloting with no negatives. Several suggested editorial changes will be made prior to submission to Society ballot. A question has been raised as to whether D 3359 is suitable for measuring the adhesion of thick, tough films. A round-robin will be conducted in which high yield epoxy and vinyl coatings applied at two thicknesses will be evaluated to answer this question.

The group is continuing its efforts to develop a tensile pull-off method for determining adhesion. Encouraging results have been obtained in determining differences in adhesion of an alkyd type coating applied to hot and cold rolled steel panels, half of which were sandblasted. The results of the pull-off tests of these panels showed that less variability is encountered with cold rolled steel and when one inch diameter cylinders are used. It was found that the level of adhesion values obtained are influenced by the type of adhesive used to cement the cylinders to the coating. An interlaboratory test is planned to determine the precision of the tensile pull-off method.

Group 11, Wet Film Thickness, H. A. Ball, Chairman, reported that after some proposed changes have been made to a new practice, "Measurement of Wet Film Thickness of Organic Coatings by Notched Gauges," it will be submitted to a subcommittee ballot.

Group 12, Dry Film Thickness, K. A. Trimber, Chairman, reported that a draft of a revision of D 1005, "Measurement of Dry Film Thickness of Organic Coatings," will divide measuring techniques into two methods: Method A—the existing procedure of using a stationary dial micrometer; and Method B—the use of hand-held micrometers. A round-robin to determine the precision of the two methods will be conducted in which coated panels using three thickness levels (1 mil, 3-4 mils, 7-10 mils) will be measured. Film thickness will be determined by measuring the panel before and after film removal.

Group 14, Mar and Abrasion Resistance, M. P. Morse, Chairman, reported that on the basis of a recent survey of D-1 committee members, a method for hardness measurements with a pendulum tester will be developed. Test results have shown that the Persoz pendulum tester can provide more sensitivity to hardness differences in coatings than can a tester using a Knoop Indentor. The method to be developed will use the ISO method as a model. It will also provide for both the Persoz and Koenig pendulum testers.

Group 15, Slip Resistance, G. D. Ernst, Chairman, will prepare a practice for determining the sliding friction of coatings. It will provide for the use of the devices most commonly used for friction measurements. These devices will consist of either pulled sled testers or sliding sleds on an inclined plane. Leather has been found unsuitable as a surface to be drawn across the coating because it does not retain a uniform, reproducible surface during testing. Stainless steel and plastic sled surfaces will be included in the practice.

Group 8, Preparation of Uniform Films of Coatings on Test Panels, M. P. Morse, Chairman, discussed a draft of a revision of D 823, "Preparation of Uniform Films of Paint, Varnish, and Related Materials on Test Panels," which will provide three procedures for preparing uniform films on test panels. They are, application by automatic spray, motor-driven dip coater, and motor-driven blade applicator. A fourth procedure, application by blade and inclined plane, has been deleted from the method on the basis that is seldom, if ever, used. The section on automatic spray machines has been updated to specify the machines commonly used now in the coatings industry.

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

C. K. Schoff, Chairman

Current projects and their progress include:

(1) The proposed method for measurement of viscosity at a high rate of shear by the ICI Cone and Plate Viscometer now has a precision statement and is ready for submission to the editorial subcommittee and then to concurrent subcommittee and D-1 ballot.

(2) The two oil absorption methods, D 1483, Gardner-Coleman, and D 281, Spatula Rub-out, are progressing. They have been put into modern ASTM format, interlaboratory testing has been completed, and precision statements are being written.

New projects include a new task group on Electrical Properties of Liquid Coatings, which is starting to write a method for an alternating current volume resistivity test for liquid coatings. This method will be important to any ASTM activity regarding electrostatic spraying and transfer efficiency. The only planned round-robin activity is to provide data for a precision statement for D 2196, Viscosity by Brookfield Viscometer.

SUBCOMMITTEE D01.26 OPTICAL PROPERTIES

C. J. Sherman, Chairman

Group 2, Color Measurement, C. S. McCamy, Chairman, reported that a proposed standard practice to select, prepare, and maintain color standards will be written and distributed to the subcommittee members by the June meeting.

A serious error in the FMC 2 equation was found in D 2244, "Instrumental Evaluation of Color Difference," which will be corrected as soon as possible.

Group 6, Hiding Power, L. Schaeffer, Chairman, will submit to simultaneous ballot a revision of D 344, "Relative Hiding Power of Paints by Visual Observation," incorporating the comments received on the last ballot, as well as a revised precision statement.

Group 11, Gloss and Goniophotometry, B. T. Merriman, Chairman, will revise D 523, "Test for Specular Gloss," to include a note about the polarization effect on gloss measurement and that black gloss standards require recalibration every two years. This will be balloted by the subcommittee.

In the balloting on the proposed new "Standard Method for Visual Evaluation of Gloss Differences Between Surfaces of Similar Appearance," a negative was received on the precision statement. This statement will be replaced with a sentence explaining that the precision is being determined. The editorial comments will be incorporated and the method will be submitted to Society ballot.

Group 23, Retroreflectance of Horizontal Coatings, N. Johnson, Chairman, will revise D 4061, "Specific Luminance of Horizontal Coatings," to include a significance and use statement and a revised precision statement and will submit it to subcommittee ballot.

Group 24, Color and Strength of Color Pigments, C. J. Sherman, Acting Chairman, reported that the two negatives received on D 3022, "Color and Strength of Color Pigments by Use of a Miniature Sandmill," on a recent simultaneous ballot were satisfied and withdrawn, opening the way for submission to Society ballot.

SUBCOMMITTEE D01.27 ACCELERATED TESTS FOR PROTECTIVE COATINGS

E. A. Praschan, Chairman

Group 2, Water Tests, G. Grossman, Chairman, has planned a round-robin to compare the four water test methods (D 714, D 870, D 1735, and D 2247) and to generate data for precision statements. This should be completed in time to discuss the results at the June meeting.

Group 4, Light and Water Exposure Apparatus, S. Totty, Chairman, reported that the responses to the questionnaire to subcommittee members requesting information on the types of cycles being used with fluorescent-UV/condensation equipment described in Practice G 53, indicated that a number of different cycles were being used in the industry, but that only three or four were in greatest usage. It was agreed that a practice should be written for consideration by D-1 that will include these cycles for the testing of coatings.

Group 9, Corrosion Tests, R. Williamson, Chairman, is working to develop an accelerated test to determine coating resistance to "scab" corrosion. This type of corrosion is of particular interest to the automotive industry. Three automotive representatives were present at the meeting to discuss what has been, and will be, done. Work with various cycles and contact with others working on this problem will continue and a display of various cycles will be shown at the June meeting.

Group 10, Accelerated Outdoor Weathering, M. P. Morse, Chairman, has completed a practice, D 4141, which will be issued in the *1983 Annual Book of Standards,* describing various outdoor accelerated test methods. Further work on this subject is being continued with an evaluation of a new "EMMA-Nighttime Wetting" cycle in Arizona. A comparison of exposure acceleration by backing panels with wood and black box exposure will be started during this next period.

Group 11, Revision of D 2485, "Coatings to be Resistant to Elevated Temperatures During their Service Life," J. Robbins, Chairman, is redrafting D 2485 in light of the negative and comments received in the March 1982 ballot. Since reapproval is overdue, an extension has been requested.

Group 14, Filiform Corrosion, R. DeGraff, Chairman, reported that the revision of D 2803, "Filiform Corrosion Resistance of Organic Coatings on Metal," will appear in the *1983 Book of Standards.* Future work of the group will center on the investigation of an accelerated method of developing filiform corrosion by increasing the test temperature.

Group 16, Chalking, J. Robbins, Chairman, reported that since the existing chalking standard, D 659, is included in the new standard, D 4214, which will appear in the *1983 Book of Standards,* consideration should be given as to whether or not D 659 should be removed.

Group 17, Evaluation of Weathering Effects, D. Gleason, Chairman, will undertake the revision of D 660, "Evaluating Degree of Checking," and D 661, "Evaluating Degree of Cracking," to update these methods with regard to the type of failures found in the current coating systems.

SUBCOMMITTEE D01.28 BIODETERIORATION

D. L. Campbell, Chairman

Group 1, Package Stability, W. B. Woods, Chairman, reported that initial results using a presumptive challenge test are promising. The performance of three nonmercurial preservatives was compared with that of a mercurial preservative in a polyvinyl acetate (pH = 7) paint. The inoculum used was *Pseudomonas Aeruginosa.* The results showed efficacy as well as capacity. A round-robin test of this procedure will be initiated prior to the next meeting.

Group 2, Rapid Determination of Enzyme Presence, A. J. Desmarais, Chairman, reported that work has been done with the Lumac system, but no results were reportable at this time. Work will be done with hydroxyethyl cellulose with a lower degree of substitution to determine if it is useable in developing a method.

Group 3, Accelerated Tests, K. A. Haagenson, Chairman, is working to use the Tropical Chamber (D 3273) to predict the long term results for fungicides in various exterior environments. Paints were exposed for 18 months on north offset fences in New Jersey, Tennessee, and Florida and north offset for six months in Puerto Rico, as well as for 18 months north undereave in Tennessee. Prior to exposure both the paints had been shelf-aged at ambient temperatures and at elevated temperatures (120° F) for one month.

After exposure on north offset fences, no correlation could be drawn between the two sets of paints. The north undereave fence showed good correlation between the heat and shelf-aged paints. The results from the north undereave fence also correlated with the results obtained from the tropical chamber. Additional data will be collected from the north undereave exposure before determining the future of this method.

Group 4, Resistance of Paint Films to Algae Attack, W. B. Woods, Chairman, reported that in order to obtain reproducible algal growth on water-leached paint films, the use of a homogenate of the algae oscillatoria is required. A detailed revised protocol, including the inoculum preparation, will be issued to each task group member.

Group 5, Recoating Mildewed Surfaces, D. L. Campbell, Chairman, reported that as the result of two negatives received on the balloting of the new "Standard Guide for Determining the Presence of and Removing of Microbial (fungal or algal) Growth on Paint and Related Coatings," corrections will be made and a section will be added indicating that inspection after cleaning may be done as agreed between the parties involved. A new draft will be submitted to simultaneous ballot.

SUBCOMMITTEE D01.29 SUBSTRATE PREPARATION FOR COATING TESTING

S. D. Ozenich, Chairman

Group 1, Sandblasted Panels, discussed in detail the types of testing that would be required to develop a practice for preparation of sandblasted panels for coatings testing.

A. A. Chasen pointed out that cleaning the panels prior to blasting would not be totally sufficient. He indicated that another cleaning should be performed just prior to coating the panels. He also pointed out that he had noticed differences in performance in the past between panels that were cleaned and those used as is. It was agreed to include the post cleaning in the test.

The subcommittee discussed the method to be used to measure the profile. One member pointed out that Tes-Tex tape would be the best to use as a permanent record of the profile could be kept. The chairman will contact K. Trimber to obtain the tape and to discuss with him the results he obtained in comparison tests between the tape and the Keane-Tator comparator.

In addition to the test fence, salt fog, and pull-off adhesion testing previously agreed upon, G. Grossman volunteered to conduct QCT and QUV tests.

The subcommittee discussed the possibility of a second phase test which would involve various types of blasting media and different batches of steel. It was the consensus that results of the first phase would have to be fully evaluated before selection of additional testing.

The chairman will contact members of the SSPC and Sub. D01.23 and D01.46 before the next meeting with the details of the planned test. Comments will be solicited along with a call for cooperators in the test program.

DIVISION 30 PAINT MATERIALS

SUBCOMMITTEE D01.31 PIGMENT SPECIFICATIONS

C. W. Fuller, Chairman

The large backlog of specifications and problems has pretty well been cleaned up. Specifications to be reviewed in 1983 and 1984 were assigned to the various task groups. The work of Committee E-34, and especially E 848, was discussed.

SUBCOMMITTEE D01.33 VARNISH & RESINS, INCLUDING SHELLAC

A. C. Abbott, Chairman

No business was conducted by the task groups on Varnishes (.01), Urethanes (.12), Alkyds (.14), and Nonvolatile Determinations (.15). The subcommittee is seeking a more active chairman for the Urethane task group. The Alkyd task group will be put on inactive status, with custodians appointed for the methods under its jurisdiction.

The subcommittee voted unanimously to recommend to the Executive Subcommittee the transfer of the Nonvolatile Determination methods, D 1259 and D 1644, to Sub. D01.21. It was also voted unanimously (9–0) to request a concurrent subcommittee and D-1 ballot for withdrawal of D 1643, "Gas Checking and Draft Test of Varnish Films," the negative on the last subcommittee ballot having been voted not persuasive at the Toronto meeting.

Group 23, Epoxy and Phenolic Resins, P. Kamarchik, Chairman, made editorial changes to the new "Test Method for Total Chloride in Epoxy Resins" as a result of the negatives on the letter ballot and the affirmative comments received. H. D. Marshall will replace P. Kamarchik as chairman of this group.

Group 24, Nitrogen Resins, J. Smith, Chairperson, will hold a round-robin to establish which of four tests for measuring formaldehyde in melamine/formaldehyde resins is the most promising for an ASTM method.

Group 25, Polyvinyl Chloride and Polyvinyl Butyral Resins, T. J. Brezinski, Chairman, reported that the new "Standard for Testing Vinyl Chloride Resins" is ready for balloting by the subcommittee. It was also reported that D 1303, "Test Method for Total Chloride in Vinyl Chloride Polymers and Copolymers," may become obsolete due to the future unavailability of sodium peroxide. The task group chairman will maintain liaison with Sub. D20.15, which is developing a substitute method.

Group 26, Polymer Emulsions, O. E. Brown, Chairman, reported that the new "Standard Guide for Testing Latex Vehicles" is D 4143-82. A round-robin will be conducted this spring to obtain a precision statement for the proposed method, "Filter Retained Solids Content of Latex Vehicles." A questionnaire will be distributed to D-1 members regarding interest in expanding the scope of this group to cover all water-reducible vehicles.

SUBCOMMITTEE D01.35 SOLVENTS, PLASTICIZERS AND CHEMICAL INTERMEDIATES

L. R. Thurman, Chairman

Action was taken by the subcommittee to resolve 31 negatives that resulted from two 1982 ballots. The details can be found in the subcommittee minutes. Twenty-four standards will be submitted for Society ballot. Thirty-nine more will be submitted to subcommittee ballot.

On a request from C. M. Lochboeler, of USAARADCOM, a discussion was held on the inclusion of packaging standards in ASTM Standards. She proposed a consideration of PPP-C-2020. H. Moore, of the Navy Construction Battalion, recommended reference to Committee D-10 Standards, if available. Concern was expressed that packaging details may impose unnecessary restrictions on parties for whom quality is important, but packaging is irrelevant. It was proposed that a section entitled "Packaging and Package Markings" could be added, which would state, "Government Procurement may require packaging according to Federal Specification PPP-C-2020 or ASTM D xxxx." The reference documents would be listed in the "Applicable Documents" section of the standard. These revisions will be included in the next Sub. D01.35 letter ballot. A copy of PPP-C-2020 will be appended to the ballot.

Group 1, Hydrocarbon Solvents, S. A. Yuhas, Jr., Chairman, needs a suitable reference for specific gravity of aromatic hydrocarbons. Since D 891 has been withdrawn by D-16, standards D 268, D 1298, D 1555, D 2935, and D 3505 will be reviewed and reported on as possible replacements at the June meeting. It was suggested that density values in addition to apparent specific gravity be included in solvent specifications.

Group 2, Oxygenated Solvents, T. H. Golson, Chairman, discussed trace water content of "urethane grade" solvents. There has been no response to a letter soliciting interest in developing a method to measure water content below 0.1% in solvents. The letter will be reissued for discussion at the June meeting. If no further interest is developed, the matter will be dropped.

Group 3, Chemical Intermediates, L. R. Thurman, Chairman, will consider a new specification for Glacial Acrylic Acid. A test method for dimer in acrylic acid will be reviewed for comments in June. A specification greater than 0.2% methyl ethyl pentanol in 2-ethyl hexanol was considered, but 0.2% was judged appropriate. A copy of the G.C. test method will be submitted to E-15 for consideration as part of their C_4-C_{13} alcohol method. Retention data for methyl acrylate will be added to D 3362 for review at the June meeting.

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 gave a brief history of the subcommittee's objectives and activities. He explained that a subcommittee ballot of the document, "New Standard Guide for Purchasing Interior Flat Latex Paint" had resulted in 15 negatives, 2 affirmatives, and 1 abstention. This ballot was mailed to all Sub. D01.41 members on January 28, 1982 with an April 9 deadline for receipt of the replies.

Since it was not practical to try to resolve the great number of negatives at the June 20, 1982 meeting, copies of all ballots returned were mailed to all Sub. D01.41 members from ASTM Headquarters on July 21, 1982. Subcommittee members were asked to study the ballots and to be prepared to resolve the negatives at the January 1983 meeting of the subcommittee.

A motion was made and seconded at this meeting, "That the subcommittee accept the negative ballots as persuasive and discard the draft of the above document." It seemed to be the consensus of those present that the proposed guide was not practical and that it should be discarded and work to solve the problem of purchasing commercial paints be continued in other directions.

Before a vote could be taken on the motion, the subcommittee was informed by the ASTM Staff that negative ballots could no longer be resolved in this manner and advised that we simply declare the matter a "no ballot."

R. F. Brady, Jr., who wrote the original draft of the guide, then moved that he be allowed to incorporate the negative ballot objections into a new draft which he would submit to the subcommittee for discussion at the June 1983 meeting. The motion was carried by a vote of 17 to 1.

W. V. Moseley, Jr., Vice-Chairman of

Sub. D01.41, then explained his activities with new executive personnel in the GSA Federal Supply Service. He has offered the services of the State of Virginia to GSA in the investigation of the possibility of a trial purchase of latex interior flat wall paint by GSA using the "Weighted Cost of Active Ingredients" method used to purchase commercial paints by the State of Virginia. GSA has agreed to start this investigation by sending samples of TT-P-29-J latex interior paint to Mr. Moseley for analysis of active ingredients. This is likely to lead to a trial purchase by this method sometime in 1983. Results of the analysis and progress will be discussed at the June 1983 meeting.

Mr. Moseley's work with GSA could lead to a rewrite of ASTM D 3927, "State and Institutional Purchasing Guide for Commercial Paints." The chairman suggested that D 3927 not be revised, but that a new document be written instead. This would preserve D 3927 in its present form for those institutions who wish to make use of it.

The need for a satisfactory method by which government agencies can purchase commercial paints and coatings, without using specifications, still exists. No new ideas were offered by subcommittee members.

SUBCOMMITTEE D01.42 ARCHITECTURAL PAINTS

R. H. Rowland, Chairman

Group 2, Practical Soil and Stain Removal, C. Tatman, Chairman, reported that the recommended practice is being submitted to the statistics subcommittee. The document was reviewed at the meeting and some editorial changes were made.

Group 4, Wet Adhesion, F. Winkelman, Chairman, discussed methods of conducting wet adhesion tests, specifically the type of substrate, type and properties of the alkyd coating to which the semi-gloss latex test coating will be applied. Six collaborators will participate in the initial round-robin, once a formal test procedure has been drafted. The use of positive and negative control paints are to be included in the round-robin.

Group 6, Standard Practice for Testing Latex Semi-gloss and Gloss Paints, S. LeSota, Chairman, reviewed the first draft of the standard. Several editorial changes were made. The revised draft will be submitted to subcommittee ballot.

Group 7, Measurement of Sag Resistance with a Multi-Notch Applicator, L. Schaeffer, Chairman, reviewed the results of the subcommittee ballot of the new proposed sag resistance method. There were no negatives, but many suggestions and comments, most of which were accepted. It was agreed that, after a further review of the precision statement, the present draft with appropriate editorial revisions would be submitted for simultaneous ballot of the subcommittee and D-1.

Group 13, Brushability, J. Desmarais, Chairman, reported that high shear readings did not correlate well in the last round-robin. Suggestions were made to send out two standardization oils to calibrate the ICI Cone and Plate instruments being used. This will be done prior to the next round-robin test. One of the samples appeared to be dilatant, according to several of the cooperators. A suggestion was made to use commercial "off the shelf" paints for the next round-robin.

Group 17, Roller Spatter, J. Price, Chairman, reported that one of the problems encountered in the most recent round-robin was the change in spatter characteristics during the course of the four months that it took to conduct the round-robin. For this reason it was decided to specify a given week in which all cooperators would perform the test in the next round-robin.

Sub. D01.42 solicits suggestions concerning future subcommittee efforts.

SUBCOMMITTEE D01.44 TRAFFIC COATINGS

R. L. Davidson, Chairman

Sub. D01.44 had no specific new activities to report. All seven of its groups met to review subcommittee and D-1 ballot results. All negatives were found to be persuasive. Comments and suggestions will be incorporated in the methods.

J. O'Brien was selected as new task group chairman of Sub. D01.44.01 on Thermoplastics. E. B. Countryman resigned as chairman of Sub. D01.44.02 on Traffic Paint.

SUBCOMMITTEE D01.45 MARINE COATINGS

L. S. Birnbaum, Chairman

Group 5, Algae Control, C. D. Stevens, Chairman, discussed the proposed method for rating antifouling coatings. Color photographs presented by Battelle Marine Laboratory were deemed unsatisfactory as standards because algae growth varies too much from one location to another. The subcommittee achievement to date is the identification of a test method for determining the degree of algal fouling. However, no consensus on the method of test exists. Chairman Stevens has suggested an immersion panel test where a single panel is immersed each month for three months along with a control. Measurement would be made of the area covered. D 3274 will be reviewed for rating method used on measuring mold growth on house paints. The chairman will provide possible rating systems and a proposed scope for the standard. A round-robin is planned after the June meeting.

Group 6, Dynamic Testing, D. Laster, Chairman, reported that static test panels do not always correlate with fouling development on ships. Rotating drum tests are underway and the chairman has developed a "Standard Dynamic Test Method for Performance of Marine Antifouling Coatings." For the use of a drum in testing, point of failure of the test panel is necessary. This, in turn, requires a rating system to define different end points. A task force consisting of Laster, Birnbaum, Perez, Chasan, and Tone will meet to discuss deficiencies in the standard and means of correcting them.

Group 7, Antifouling Rating, C. Perez, Chairman, reported that one of the round-robin cooperators (Pearl Harbor) delayed exposure of the dynamic test panels for an entire year. The panels were put on test in November 1982. One month later, as a result of a hurricane, power was lost. L. Birnbaum moved that the Navy Laboratory be informed of the subcommittee's intent to discontinue further testing. Meanwhile, the static test panels are in place and the test proceeds. Chairman Perez provided pictures of 10-month exposures to both dynamic and static conditions from two test locations (Battelle and Miami Research). Most test panels show no fouling. Fouling does appear on a few and it is expected that significant differences will appear within three months. Thanks were extended to Chairman Perez for an excellent report.

The meeting of Sub. D01.45 was concluded with a review of projects for future subcommittee work, including: (1) surface profile measurements of antifouling paints; (2) evaluation of underwater brush cleaning; (3) measuring release rates of bioreactive materials from antifouling coatings; (4) evaluation of ablation dates of ablation coatings, and; (5) inspection of ships for performance of antifouling coatings.

SUBCOMMITTEE D01.46 INDUSTRIAL PROTECTIVE PAINTING

D. M. Berger, Chairman

Group 2, Surface Preparation, J. D. Keane, Chairman, defined the need for a guide to describe proper use of the various devices suitable for surface profile measurement in the field. The following are to be included in the guide: replica tape, comparators, the British developed "Rough Tector", depth micrometers, and the profilometer. The SSPC microscope method will be used as a reference. J. D. Keane turned over the background file already compiled on profile measuring devices. S. Oeschle, of Tegman, Inc., will chair the group.

D. M. Berger urged that the group consider the problems of contamination in abrasives and their effect on surface preparation and coating performance. W. Johnson, of KTA Associates, volunteered to provide a draft of a guide on techniques of checking abrasives prior to use.

Group 3, Painting Practice for Field Applied Coatings, D. Noxon, Chairman, discussed a draft document, "Standard Method for Field Identification of Weathered Coatings." The proposed method is based on a kit developed by the Navy Civil Engineering Laboratory, Port Hueneme, CA. Five basic tests are used to identify the generic types of binders. This draft will be circulated to the subcommittee members for comment. The group considered the problem of compatibility of new coatings to be applied over the weathered coating, but deferred action until the work on the test kit draft was further along.

Group 4, Pull-Off Adhesion Test, A. Cunningham, Chairman, was attended by a good cross-section of users and producers, as well as those with a general interest in adhesion testing. This was a great help in working out the details of a round-robin test series planned to develop the required data for precision and accuracy statements. Panel size will be 6″× 12″ in both 1/4″ and 1/8″ thicknesses in order to assess the effect of panel flexing on accuracy of the measurement. Four coating systems will be used for the round-robin: coal tar epoxy, alkyd, two package epoxy, and a high build vinyl. The earlier decision to use only specification coatings was reversed in favor of using proprietary coating systems. The group was of the opinion that coating suppliers would be more than willing to cooperate in supplying a stock item.

The group agreed that both the coating surface and the dolly should be abraded to obtain a good adhesive bond. The practice of scoring around the dolly proved to be controversial. Heavy elastomeric coatings would require scoring, but there was no general agreement on practice with thinner coatings. This variable also will be studied in the round-robin. The required adhesive (Hysol 907) will be supplied to all cooperators from a single batch. Elcometer pull-off adhesion testers must have been calibrated recently by PPL, Pittsburgh to qualify for use in the round-robin.

Group 7, Inspection, R. J. Martell, Chairman, reviewed the status of the Guide for Paint Inspectors. Comments received earlier will be incorporated in a revised text and a check list detailing an orderly inspection procedure will be added. The group resolved the outstanding negatives on the ballot for the revision of D 1014 "Conducting Exterior Exposure Tests of Paint on Steel." The comments from this ballot and editorial changes recommended by H. E. Ashton will be incorporated in the document.

The Sub. D01.46 Secretary was asked to check with Sub. D01.29.01 regarding their work on a standard for panel preparation for lab testing to avoid an overlap of effort.

SUBCOMMITTEE D01.48 ZINC RICH COATINGS

D. C. Kinder, Chairman

Group 2, Determination of Cure, J. Lanning, Chairman, presented work on correlation of the "coin" test and pencil hardness. Elcometer adhesion results were also reported. Test work was reviewed comparing the MEK solvent rub test with pencil hardness using an epoxy zinc rich coating.

Group 3, Laboratory Test Methods, R. H. Wakefield, Chairman, circulated a first draft of the circle test and the V-notch test. Comments on these tests are to be made prior to April 1, so that a letter ballot can be prepared prior to the June meeting. J. Evarts reported on the SSPC zinc rich performance test series correlating salt fog results and the bullet hole test.

Group 5, Topcoating of Zinc Rich Primers, D. C. Kinder, Chairman protem, discussed the SSPC's five year report, "Topcoats for Zinc Coatings." It was concluded that the report was valuable for general information, but would be difficult to write up as an ASTM guide.

Group 4, Determination of Porosity and Volume Solids, D. C. Kinder, Chairman protem, reviewed the NACE Publication 6A181, "Determination of Theoretical Coverage Rates of Inorganic and Organic Protective Coatings," (from Sept. 1981 *Materials Performance*). For zinc rich coatings, a modified ASTM D 2697 procedure is used. Modifications include use of mercury as the suspending medium and tungsten panels. Comments included the acceptance (or lack of) of using mercury as the suspending medium, and the poor reproducibility of results encountered using D 2697 with organic coatings. The subcommittee responsible for D 2697 will be requested to evaluate the NACE modified procedure.

DIVISION 50 PAINTS FOR FACTORY APPLICATION

SUBCOMMITTEE D01.51 POWDER COATINGS

C. Grenko, Chairman

The subcommittee and task groups met concurrently in one session. It was reported that Sub. D01.51.02, Physical Properties of Powder Coating Materials, has two methods under consideration for testing base resins. Subcommittee members discussed means of rekindling interest and participation in Sub. D01.51. Since the adoption and subsequent reapproval of D 3451, "Standard Practice for Testing Polymeric Powders and Powder Coatings," interest appears to have waned. A relatively short term achievable solution of a powder application problem would probably stimulate renewed activity. Most problems in this changing and developing field are of a more long term nature.

(Subsequent to this January 25 meeting, the Powder Coatings Institute has a subcommittee on test methods within its technical committee, chaired by Kevin K. Kipp, of the Ferro Corp., which is joining with chairman Grenko in organizing first an interim meeting in April and then a half day session of Sub. D01.51 at the D-1 meetings in June.)

SUBCOMMITTEE D01.52 FACTORY-COATED WOOD PRODUCTS

R. C. Marck, Chairman

Group B, Hardboard, S. B. Schroeder, Chairman, discussed recently identified problems concerning the swelling of hardboard siding due to surfactants in some water-borne house paints and environmental factors, such as mist or fog.

Data was presented showing possible correlation between test fence exposures and a proposed rapid method now being evaluated by the American Hardboard Association. This data will be sent to all attendees of the last two meetings with a request for volunteers to participate in a round-robin to verify the validity of the rapid test.

Group 12, Textured Wood Products, R. C. Marck, Chairman, discussed a report prepared by Oregon State University on abrasion and adhesion tests on finishes on textured hardboards. A useful test method was not developed for each property. Preliminary tests are in progress to determine the vulnerability of wood substrates to weathering once the finish has been removed from the high spots of textured siding. This work will be completed and a report prepared for the June 1983 meeting.

Group 52/55, Formaldehyde Emissions, J. Smith, Chairman, discussed formaldehyde emissions in wood products. It was agreed that the problem was caused by the binders in some wood products, which fell under the jurisdiction of Committee D-7. A letter suggesting that D-7 study the problem, rather than Sub. D01.52 or D01.55, will be sent to D-7.

SUBCOMMITTEE D01.53 COIL COATED METAL

R. A. Cassel, Chairman

Group 1, Formability, W. H. Gunn, Chairman, discussed a proposed precision statement for D 4146. After a review by H. E. Ashton, the document will be submitted to simultaneous ballot of Sub. D01.53 and D-1.

Group 2, Cure, R. A. Cassel, Chairman protem, is planning a current round-robin which should resolve some of the weaknesses found in the last round.

Group 3, Pretreatment, R. L. Williamson, Chairman, discussed the future coating weight methods to be documented. A round-robin is planned for zinc and iron phosphate coatings on steel surfaces. The final draft of the zinc phosphate coating weight on galvanized steel is ready for ballot.

SUBCOMMITTEE D01.55 FACTORY-APPLIED COATINGS ON PREFORMED PRODUCTS

F. Zurlo, Chairman

Group 1, Coatings for Wood Products, M. E. Mull, Chairman, discussed D 3133, "Quantitative Determination of Cellulose Nitrate in Alkyd Lacquers by Infrared Spectrophotometry." This method was reviewed by Hercules resulting in one suggestion for an additional comment in Section 9.1 referencing Figure I, which is not otherwise referenced in the method. After a discussion of D 2353, "Test for Flow Ratings of Organic Coatings Using the Shell Flow Comparator," it was agreed to add a significance and use statement. In a discussion of D 1211, "Test for Temperature-Change Resistance of Clear Nitrocellulose Lacquer Films Applied to Wood," it was reported that two lacquers, one with good cold check resistance, the other with only a few cycles capability, have been received at the Hercules Research Center. The panels received from Georgia Pacific were not satisfactory. Hercules will obtain suitable wood panels and prepare the test specimens for a round-robin.

Group 7, Industrial Water Reducible Coatings, F. Zurlo, Chairman, was presented with a proposed practice for testing of Industrial Water Reducible Coatings in final draft form. Corrections and suggestions made at the June meeting had been made.

The subcommittee decided to submit this practice to a Sub. D01.55 ballot.

SUBCOMMITTEE D01.56 PRINTING INK

J. M. Fetsko, Chairman

Group 2, Lightfastness, J. Benson, Chairman, described plans for a forthcoming round-robin to upgrade the current ASTM method for printed matter. Using predispersed pastes of Lithol Rubines, participants will make prescribed letdowns and prints. Fadeometer exposure cycles will include standard NBS test papers.

Group 6, Ink Tack, C. Shepard, Chairman, distributed a detailed description of a proposed round-robin required to develop a precision statement for the new standard, "Apparent Tack of Printing Inks by the Inkometer." Ten tests are to be run on each of six inks.

Group 9, Tinting Strength, A. Scarlotti, Chairman, distributed results of a round-robin in which relative strength of a lithol rubine dry color was determined using 1:50 letdowns in a non-drying zinc oxide base. Gravimetric measurements generally agreed with the "true" relative strength better than did instrumental approaches. Ways will be explored to improve the accuracy and precision.

Group 10, Water Uptake, G. Bien, Chairman, discussed results of a round-robin designed to test the effect of the fluid on emulsification rate. It was noted that with some case history samples, neither quantity nor rate of water uptake differentiated properly between good and bad inks, indicating that other characteristics influence lithographic printing performance.

Group 11, Non-Volatile Matter in Heat-set Inks, B. Blom, Chairman, reported that, on the basis of a round-robin conducted with three inks, the sample size should be restricted to 100 g/m^2 in order to keep oven time to the desired one hour. At the request of an ASTM official, the subcommittee agreed to accept the higher weight per unit area prescribed in two existing methods. A new round-robin will be required to select the oven time that gives the best precision and accuracy.

Group 12, Fineness of Grind, J. Cichon, Chairman, distributed test results of a round-robin conducted for the purpose of preparing the required precision statement for D 1316, "Fineness of Grind of Printing Inks by the Production Grindometer." It was noted that gloss readings directly on the drawdowns differentiated among the test samples far better than did scratch readings. Further work on this aspect will be discussed at the next meeting.

Group 13, Ink Mileage, B. Blom, Chairman, reported that, although a previous round-robin gave excellent results, future round-robins should be conducted with inks having known press performance. H. Robbins agreed to provide two sets of process color inks which exhibited wide differences in mileage during a long-term printing job.

SUBCOMMITTEE D01.57 ARTISTS' PAINTS AND RELATED MATERIALS

J. T. Luke, Chairman

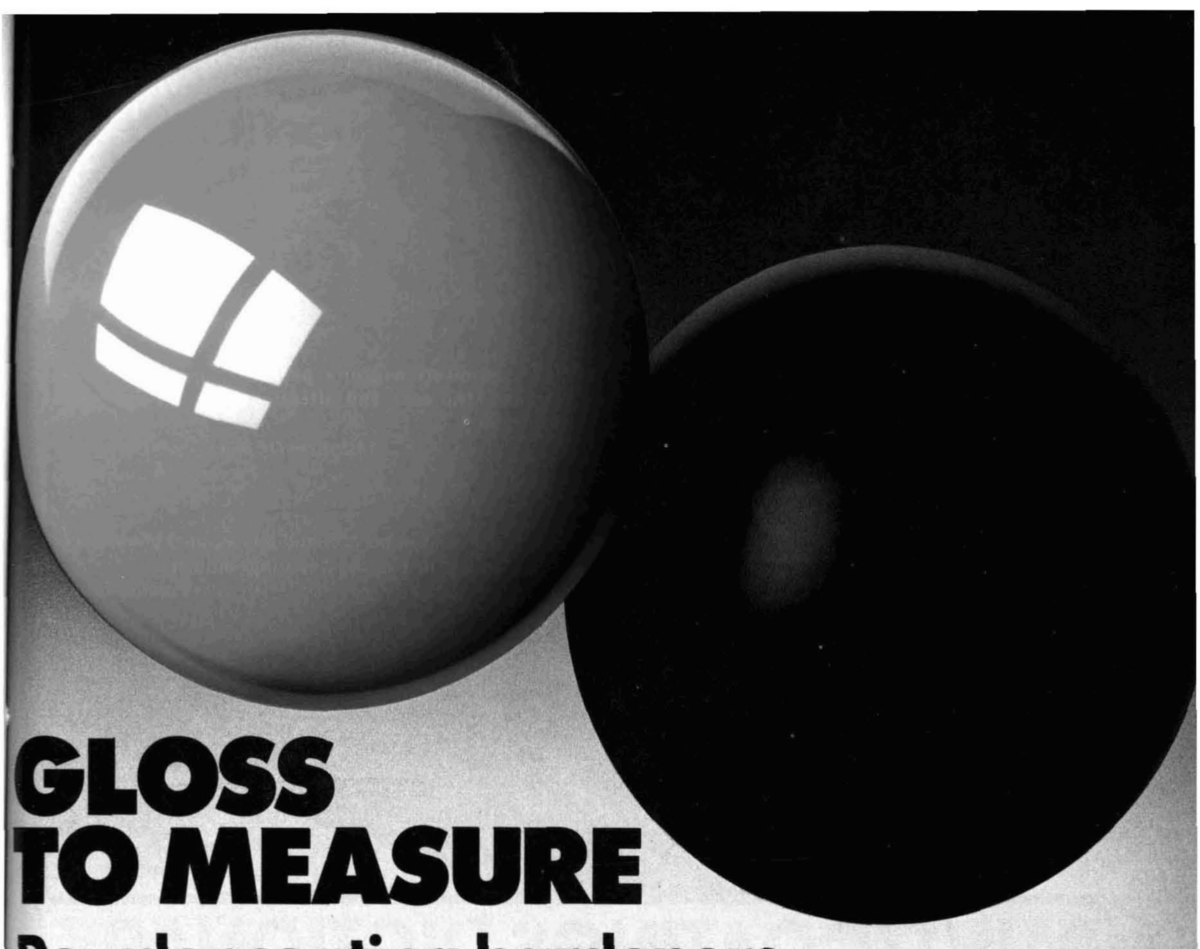
There were three negatives and several comments on Draft 13 of D 4236, "Practice for Labelling Art Materials for Chronic Adverse Health Hazards," which were received on the D-1 Committee ballot. All negatives and suggestions have been considered and the reasons for accepting or rejecting a suggestion given to the author of the comment. All negatives were withdrawn based on an agreement among all parties on a revision, Draft 13, which will closely follow Draft 12 in the balloting process.

In the effort to accommodate the interests of small companies, large companies, consumers, and government agencies, this labelling standard has gone through 12 drafts in under two years. During this process, uniformity of language was lost. Everyone agreed that since an agreement was reached on the requirements by all interested parties, the standard should be reworded for clarity and uniformity.

This has been done with the assistance of the negative voters and draft 13 will be sent out promptly on a simultaneous ballot of Sub. D01.57 and D-1. Meanwhile draft 12 will continue through Society ballot in February. Handling the standard in this way will enable manufacturers to begin conforming to the practice in the Spring, since the requirements in Draft 12 and Draft 13 are the same, but the better worded Draft 13 will appear in the *1984 Book of Standards.*

A motion was passed that Draft 13 will be provided whenever possible, in addition to a copy of Draft 12, to those individuals who request a copy of the standard prior to publication of the *Book of Standards.*

Work is completed on two other Sub. D01.57 standards, Specification for Artist's Paints and Methods for Determining Relative Lightfastness of Artists' Paints Exposed Under Glass. They will be sent out for subcommittee ballot as soon as they have been reviewed one more time for editorial changes.



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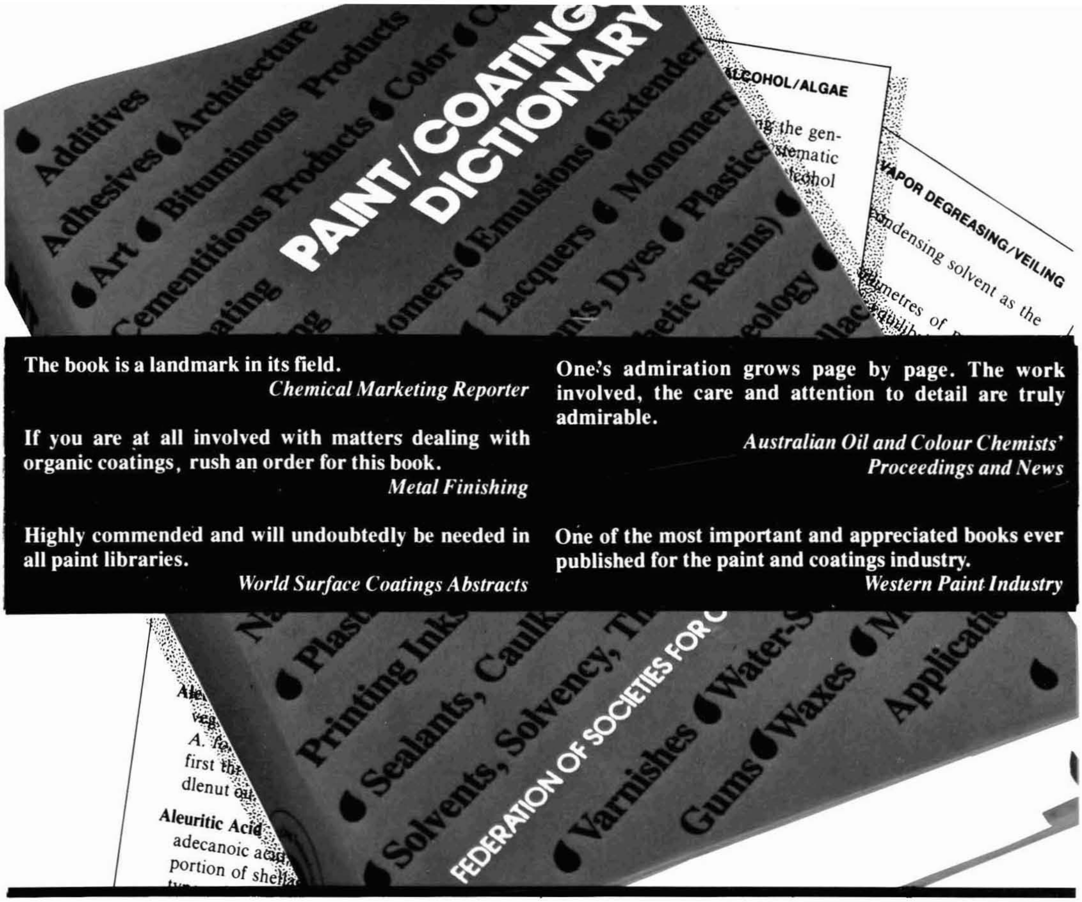

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Society Meetings

BIRMINGHAM .... JAN.

"Paint Production"

Frank Tennant, of Carrs Paints Ltd., spoke on "PAINT PRODUCTION—A NOVEL METHOD."

Slides and pieces of equipment illustrated Mr. Tennant's discussion on how to produce paints from raw materials in liquid form, i.e., resins, tinters, and thinners.

Mr. Tennant explained a system which incorporated storage tanks and mixing vessels (Boats) which were controlled by computer for weighing, volume, and mixing.

When production commences, the computer first checks the stocks situation and prints out the formulation. The operator is given instructions via display units and a telephone while the computer operates switches etc. to allow the correct amounts to enter the Boat, said Mr. Tennant. Final weights are recorded and printed out by the computer. The accuracy of weighing is to .05%, which with reproducibility leads to better quality control. If the testing of the finished product shows up any failings, the formulation final print out will confirm that correct quantities were used, and further additions to correct the product can then be done via the computer, explained Mr. Tennant.

This method does away with pipework and meters and generally speeds up the throughput of orders, stressed Mr. Tennant.

Q. Does the floor have to be flat and clean?

A. Yes, both are very important. We seal the floor regularly with an epoxy paint to avoid the air going into the pores of the cement.

Q. How much noise and dust are created?

A. Hardly any. Due to the whine of the air motor and the design, hardly any air escapes under the rubber cushion.

Q. What maintenance is required for the air bearings?

A. They are very easy to detach and wipe over, but normally this is needed only about every six months. We have now found a way to repair the cushions ourselves.

Q. Is console operator competence a problem?

A. No. She does not really carry out the work. There are a number of safeguards including the telephone link. In two years no incidents occurred of wrong materials being added.

Q. Is it easy to stop the transporters from moving?

A. The Dead-Mans handle lets it drop immediately. But as this is only about ¼", no damage is done to equipment or contents.

Q. How do you clean the Boats out?

A. Manually with solvent.

Q. Do you change formulations automatically by the computer as the quality of the concentrates or resins alter?

A. The laboratory makes changes, but reproducibility is what this method controls. Ingredients must be added in the same order each time, as printed out on the formulation.

Q. Would it be possible to have all the manual jobs replaced by robots?

A. Yes, when money permits, which does not mean we would decide to do it ourselves.

Q. What is the smallest amount of finished product that can be made?

A. About 500 litres. Small quantities of ingredients can be weighed out in the laboratory, also with a print out of quantity.

Q. What are the advantages?

A. It is safer, speedier, and cleaner than other methods.

Q. How do you control the quality of your pre-mix tanks?

A. Good formulations, and continually stirred.

Q. What would happen if your computer console packed up?

A. We have back-up facilities but initially would have to return to a manual system.

D.H. CLEMENT *Secretary*

BIRMINGHAM .... FEB.

"Formaldehyde"

"FORMALDEHYDE—RELEASE AND ANALYSIS IN AMINO RESINS" was discussed by A. Bjoerseth, of Dyno Industries.

Formaldehyde has been extensively used for over 40 years in crosslinking resins, and remains indispensible, despite the lowering of the TLV to 1 ppm, stated Mr. Bjoerseth.

Toxicological evidence remains a little indecisive, but it is agreed that concentrations in the atmosphere of 3 ppm cause distress by mucous membrane irritation, with evidence of acute allergenic reaction in humans and cancers in test animals.

A new test method for formaldehyde, involving reaction with sodium sulphite and back titration of the excess with iodine following the addition of sodium carbonate, is expected to become a new DIN and ISO standard, said Mr. Bjoerseth.

According to Mr. Bjoerseth, analysis of released formaldehyde must be done under reproducible conditions, and is affected by a variety of factors, the most significant being the relative humidity of the surroundings and the type and concentration of added acid catalyst.

Q. Is the reaction to formaldehyde allergenic or poisoning?

A. Allergenic, which may lead to hypersensitivity. Formaldehyde is still a poison.

Q. Is formaldehyde not more problematical dermatologically?

A. We have no evidence to that effect. Cancer is still being checked for.

Q. Is humidity more important than pH in determining emission levels?

A. Yes. It is also more significant than the UF resin type.

Q. Are the same resin types used for both coatings and cavity wall insulation?

A. The types used in cavities are more etherified and contain more methylol groups, which are more easily split to free formaldehyde.

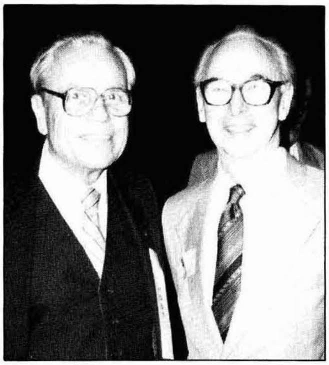
Q. What levels of formaldehyde are present in the atmosphere from smoking and car exhaust emission?

A. Approaching 1 ppm.

Q. What is the effect of different alkyd type on formaldehyde levels on curing?

A. We have no data.

Q. How does the emission of formaldehyde from 100% solids systems differ from that from water or solvent carried systems?



Dr. Walter Asbeck (right) discussed "Dispersants" at the Cleveland Society's February meeting. Also in attendance was Federation and Cleveland Society Past-President, Mike Malaga

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A. The presence or absence of solvents affects only the rate of emission, not the total amount. Solvents may also interfere with determinations of formaldehyde emitted.

D.H. CLEMENT, *Secretary*

C-D-I-C .... FEB.

"Rheological Additive"

Robert H. Dey, of NL Chemicals, Coatings and Specialties Laboratory, presented a talk entitled, "QUALITY AND CONSISTENCY FROM AN EASIER DISPERSING RHEOLOGICAL ADDITIVE."

Mr. Dey discussed the properties developed with the addition of organoclays (bentonite) to a paint system. Organoclays are used to impart viscosity, sag, and pigment settling control and application properties to solvent base paints. Conventional organoclays require polar activation, addition to a paint system in a specific order, and high shear to develop good dispersion and good performance, explained Mr. Dey.

Through research, a new type of "super" dispersible organoclay has been discovered which requires only minimal shear and no chemical activation for the development of full rheological properties. Such easy dispersion allows for the first time, the super organoclay to be added at any point in the manufacturing process, including post addition to the let down and ensures consistent development of rheological properties, said Mr. Dey.

A variety of evaluations in aliphatic solvent based coatings were reviewed by Mr. Dey including performance under a range of manufacturing conditions.

DAVID C. KINDER, *Secretary*

CLEVELAND .... FEB.

"Dispersants"

Dr. Walter Asbeck, retired member of the Cleveland Society, presented a talk entitled, "DISPERSANTS: BASIC CONCEPTS AND EFFECTS ON PAINT PROPERTIES."

Dr. Asbeck described some of his early work on the critical pigment volume concentration of titanium dioxide/linseed oil paints. The varying results obtained led to a study of pigment wetting characteristics and a study of pigment wetters or dispersants, polarities, and surface energetics, explained Dr. Asbeck.

Today, stated Dr. Asbeck, a coating chemist must be an organic chemist, a high polymer chemist, a physical chemist, an inorganic chemist, and a rheologist.

Dr. Asbeck concluded that the rheological properties of a coating can be manipulated by using dispersants to modify and control the numerous energy factors inherent in the coating.

RAYMOND PODLEWSKI, *Secretary*

GOLDEN GATE .... JAN.

"High Solids"

Rich Johnson, of Cargill, Inc., spoke on "THE MARKET FOR HIGH SOLIDS."

Mr. Johnson projected a change in industrial coatings in the 80's. Early in the 80's, high solids were 4% of the total. He anticipated that by 1985 high solids would account for 14% of the total and by 1990, 20% of industrial coatings would be high solids.

Why is there the growth in high solids? Mr. Johnson explained that the following factors influenced the growth: (1) ease of formulation (stability); (2) efficiency of application (equipment); (3) outstanding economics; (4) government regulations (low VOC); (5) performance; (6) versitility (A.D., bake, 2 component); and (7) new technologies.

Mr. Johnson discussed new technologies and gave as an example—water-extendable, high solids polyester resin. According to Mr. Johnson, 20-50% of organic solvent can be replaced with water. The resin system is extendable, not soluble. This allows the formulator to achieve the same VOC with a lower viscosity or a reduced VOC at equal viscosity.

High solids are a relatively new technology, stated Mr. Johnson. It takes work and a commitment on the part of both formulator and user to achieve a satisfactory system.

ROBERT MILLER, *Secretary*

KANSAS CITY .... FEB.

"Synthetic Silica Flatting Agents"

Manufacturing Committee Chairman, Larry Kytasaari reported that an updated slide presentation on "The Operation of the Vertical Sandmill" is completed and will be reviewed by the Federation.

Peter Marsden, of W.R. Grace Co., discussed "SYNTHETIC SILICA FLATTING AGENTS."

Mr. Marsden explained that there are four types of synthetic silica: (1) pyrogenic (fumed)—cabosil, aerosil, and wacker; (2) precipitated—OK4A, sylox, lovel, zeothix; (3) gel—syloid, silcron; and (4) super gel—syloid.

Mr. Marsden mainly discussed the advantages and disadvantages of the gel and the new super gel silicas.

Gel silicas have a refractive index close to the refractive index of most clear coatings resins. Therefore, clear semigloss and flat finishes can be accomplished without that cloudy look some flatting pigments give, said Mr. Marsden. When using gels, a lot lower loading is required to get flattings which is a great advantage for coil coatings. These two characteristics, clarity and efficiency, are the main advantages that silicas have over other flatting pigments. Other good characteristics of silica pigments are (1) purity, (2) uniform particle size, (3) inertness, (4) ease of dispersion, and (5) surface treatment, explained Mr. Marsden. The surface treatments are for mar resistance and anti-settling.

The new super gel silicas are an improvement over the gel silicas, stated Mr. Marsden. They are (1) high flatting, (2) low viscosity, (3) easily dispersed, (4) cost effective and (5) excellent for overgrind resistance.

Q. What are the chances of the cost of the gel and super gel silicas coming down?

A. Because the current manufacturing methods require great amounts of energy usage in the process, lower prices are out of the question now. Davison is currently working on a different process which, if successful, would lower the cost of manufacturing.

Q. Are all silica gels treated?

A. No, just a few grades are treated.

Q. Are all super gel silicas "stir-in" grade?

A. Yes, all can be "hand shaken" to a 6 grind in 30 seconds.

Q. Can the super gels be overground on a high speed mixer?

A. No. There would be no problem with high speed, but if ground on a pebble or steel mill they would definitely be overground and you would lose your flatting efficiency.

GENE A. WAYENBERG, *Secretary*

LOS ANGELES .... FEB.

"Ladies' Night"

President Romer Johnson congratulated Earl Smith, present Treasurer and 1981-82 Secretary, who was awarded the Ernest C. Trigg Award by the Federation.

Also recognized by President Johnson was the society's Technical Committee for its award-winning paper which was presented at the Annual Meeting in Washington, DC. Certificates were awarded to all committee members.

Jim Elliott, Environmental Committee Chairman, reported that the San Diego Air Quality Board had settled on 380, and 250 grams per liter, and had exempted Mill white and Quick Drying Enamels. Also, he said that at the Air Quality Board meeting in San Francisco, the feeling was that on the 18 exempt products, the final solution will probably be to cut down on the allowable VOC from the present limits. The present level is 380 grams per liter and it is supposed to drop to 250 on September 3, 1983, said Mr. Elliott.

Ken O'Morrow noted that the disposing of hazardous waste in drums to a land fill has been extended temporarily, but will soon be discontinued.

Clara Berg, Color Coordinator, discussed how one should use color. Working with volunteers, Ms. Berg coordinated color swatches with each individual's skin tone.

Q. What is the ideal color for an olive skinned brunette?

A. This person is a Winter person, and looks best in red.

Q. What is a good color to wear with turquoise?

A. Use violet, beige, or off-white.

Q. How does the system correlate with Malloy's Book "Dress for Success"?

A. This system is quite similar. It is how people perceive you is how your life goes. Colors can change your appearance to others.

Q. Are all pale skinned blue-eyed blonde people, Spring people?

A. No.

Q. Have you heard of the Ostwald Color System?

A. I have heard of this system, but I cannot remember how it goes.

Q. How should one choose the color of socks? To match the color of shoes, or pants or shirt?

A. Match the shoes and the pants.

Q. You presented the meaning of colors as they relate to people. Why have you emphasized the facial part? Don't colors influence the whole individual?

A. Yes, colors influence the whole individual, but I am concerned with the color that people wear closest to their face because that will change their skin tone. The colors they wear certainly make a difference in the mood or image.

Q. What about color preference as it relates to the type of personality?

A. I have found that color preference influences the personality of people. Shy people wear dark somber colors, and extroverts wear bright colors.

MICHAEL M. GILDON, *Secretary*

Federation President A. Clarke Boyce (left) is shown at a meeting of the Mexico Society on February 28. Shown with him in Mexico City are (left to right): Mauricio Esquivel, President of the Mexico Society; Miguel Guevara, President the Mexico Association of Paint and Ink Manufacturers; Luis G. Torres, Manager of the Mexico Association; and Tony Pina, Mexico Society Representative to the Federation Board of Directors and a Past-President of the Mexico Association

MEXICO .... JAN.

"Election of Officers"

The following were elected to serve as officers for 1982-83; President—Mauricio Esquivel, of Pinturas Azteca, S.A.; Vice-President—Teresa Suarez, of Sherwin-Williams, S.A. de C.V.; Secretary—George Carrington, of Noudex Mexicana, S.A.; and Treasurer—Antonio Herrera, of Intertrade, S.A.

GEORGE CARRINGTON, *Secretary*

NEW YORK............... JAN.

"Organoclays"

A moment of silence was observed for Dr. William P. Ferren, of Wagner College, and Dr. Berthold Winston, formerly with Absolute Coatings, Inc., who passed away in 1982.

Tom Powell, of United Catalysts, discussed "ORGANOCLAYS."

Mr. Powell noted that there are two types of quaternary amines used to treat organoclays. One is the dimethyl hydrogenated tallow benzyl ammonium ion. The other is dimethyl dihydrogenated tallow ammonium ion. The choice of treatment depends upon the polarity of the system in which it is to be used. More polar systems should get the DMHB treatment. Low to medium polarity systems should use the ditallow quaternary amine treatment. Of course these are not the only quaternary amines available to treat organoclays, explained Mr. Powell.

Organoclays are defined as being high swelling or low swelling, according to Mr. Powell. Poor (low) swelling clays are those where the quaternary amine is reacted with the clay surfaces but not with the entire lattice of the clay. The high swelling organoclays are those that are delaminated, then treated with quaternary amine so that the entire structure receives the amine treatment. The relative amount of quaternary amine is not under question, the distribution is what is under question, stated Mr. Powell. Other influences on swelling include level of quaternary amine, type of amine, and the type of clay used.

One important point, said Mr. Powell, is that the greater solvation energy that dissociates the organoclay the less physical work is required to disperse the product. Also, the distance between platelets drops exponentially not linearly. Also of note, stressed Mr. Powell, is that high acid number alkyds (such as chain-stopped alkyds) can swell organoclays without activator. This is strictly due to hydrogen bonding. Just as important to gel formation is free water in the system, said Mr. Powell. An anhydrous system will not swell organoclays, whereas, a system with traces of free water will.

Temperature and KB of solvents play a role in swelling of clays. The higher the KB solvents, the greater the swelling. Likewise, hotter solvent makes for greater swelling, colder solvent means reduced swelling, explained Mr. Powell. Other outside factors which can reduce swelling include impurities, agglomerates in the material, and moisture content.

MICHAEL ISKOWITZ, *Secretary*

PHILADELPHIA .... FEB.

"High Solids Coatings"

President Ralph Myers welcomed members of the Philadelphia Printing Ink Makers Production Club.

Dennis G. Miller, of Cab-O-Sil Division of Cabot Corp., spoke on "HIGH SOLIDS COATINGS."

The rapid growth in the production of high solids coatings was discussed. Mr. Miller predicted that this trend will continue.

According to Mr. Miller, high solids coatings are based on low molecular weight resins, resulting in two rheology related problems: (1) sagging during the hear cure cycle and (2) pigment settling on aging.

A number of slides illustrated various tests and equipment used in testing.

Mr. Miller explained how he had evaluated several thixotropes in order to solve these problems in a typical high solids coating. The results showed that fumed silica can be a very effective thixotrope to solve these problems with minimal side effects of viscosity increase and gloss reduction.

Q. What organo clay was used in the tests?

A. Bentone 34 was used.

Q. Why didn't they try using Bentone 27?

A. Most suffer rheology problems with highly polar solvents.

WILLIAM GEORGOV, *Secretary*

PITTSBURGH .... FEB.

"Quality of Consumer Paints"

Tom Greer, of PPG Industries, Inc., gave a talk entitled, "CONCERNING THE QUALITY OF CONSUMER PAINTS."

Mr. Greer reviewed the trends in trade sales paint quality and the factors controlling these trends during the 10 year period, 1971-1981. He pointed out that many things affected paint quality, but that the major ones were economics, government regulations, technical developments, marketing, and customers.

Mr. Greer showed that inflation and other economic factors had put great pressure on paint quality, tending to reduce it because profit margins were cut severely. Raw material costs tripled from 1971 to 1981, but paint prices only doubled, said Mr. Greer. For example, setting 1967 prices at 100, the Kline Index showed that TiO_2 climbed from an index of 94 to 249 in the 10 year period; calcium carbonate from 72 to 221; yellow iron oxide from 110 to 334; poly(vinyl acetate) latex from 100 to 190; and xylene from 100 to 570. In the same period the average price for a gallon of paint went from $3.62 to $7.21.

Mr. Greer described the great effect that government regulations have had on paint costs and quality. He pointed out that regulations were closely tied to and had a considerable negative influence on technology in that much technical effort was spent meeting the demands of the regulations. This, of course, also impacted on cost. Mr. Greer gave several examples of the effects of regulations. One was the severe restriction on lead in paints. He said that paint manufacturers had to shoulder the blame for the high blood levels of lead in people, even though there was no proof that this was caused by paints being produced at that time. In fact, subsequent research appeared to show that lead in gasoline was the major source, stated Mr. Greer. Because the lead in paint must be kept below 0.06%, the industry is denied the use of lead chromate pigments. Bright yellows and oranges must now be made with expensive organic pigments which have no corrosion inhibiting ability. There is no question that the quality of such paints has suffered. In addition, lead driers also have had to be removed, taking away the most effective agent for fast, thorough cure of alkyds, explained Mr. Greer.

Other restrictive regulations and agencies including the Clean Air Act and the checkerboard of state regulations in this area were discussed. These regulations weigh heavily on the paint industry and customers, partly because they differ nearly everywhere. Interestingly enough, these restrictions have led to technological developments—high solids and waterborne coatings, many of which are better than the conventional coatings they replace, and new applications.

Health and safety testing, however necessary, contributes to cost and places a burden on technologists who become less available for research and development, said Mr. Greer. The overall effect is one of a reduced rate of innovation. As proof of this, Mr. Greer showed a table of patents granted for coatings, inks, and related products and processes. The number of U.S. patents was dropping every year, whereas patents outside the U.S. were increasing at a considerable rate. He blamed this on too many people spending their time on regulation work rather than on innovation.

Mr. Greer discussed the effects of marketing on quality. Unfortunately, the major thrust is price, not quality. The consumer does not consider factors other than price and the paint industry must bear most of the blame for this. The whole emphasis is on price-cutting: 60% of all architectural paints are bought on sale! The most important factor is price and therefore, quality must suffer.

According to Mr. Greer, two areas where quality is important to the customer are commercial industrial (maintenance) paints and contractor applied paints. With both types, application labor costs are high, so long-lived coatings are essential. In particular, commercial industrial coatings must provide very high levels of performance. Professional organizations such as contractors' associations, the National Association of Corrosion Engineers, and the Steel Structures Painting Council have had great positive influence on quality.

The customer as a factor influencing quality was discussed. Mr. Greer pointed out that consumers have little expertise concerning quality and little or no technical knowledge, so it is very difficult for them to determine paint quality. Many turn to *Consumer Reports* which has become a more realistic evaluator of quality over the last several years. Mr. Greer said that many of *Consumer Reports* tests were more practical than those in the paint industry. He emphasized that the architectural coating industry needs to develop better and more practical quality tests. Real quality must be defined and then produced, said Mr. Greer.

Consumers are slowly becoming more willing to pay for quality, said Mr. Greer. The paint industry can make quality paint, but not for $4.99/gallon. Quality costs money, but the cost of not producing quality is even more expensive because it involves losing out to competitive materials such as vinyl wall coverings, stressed Mr. Greer.

CLIFFORD SCHOFF, *Secretary*

Future Society Meetings

Birmingham

(June 8)—VISIT & PRESENTATION by A. Clarke Boyce, President of the Federation.

Cleveland

(May 17)—"A FUNNY THING HAPPENED ON THE WAY TO THE COATINGS TECHNICAL MEETING"—Frank Borrelle, FSCT Executive Vice-President.

Golden Gate

(May 16)—"BENEFITS OF COMPOSITE DISPERSANTS IN COATINGS AND COLORANTS"—Elio Cohen, Daniel Products.

(June 13)—MANUFACTURING COMMITTEE'S SEMINAR—"Conference '83—Paint Manufacturing Methods Update."

Kansas City

(June 10-11)—JOINT MEETING of the Kansas City/St. Louis Societies.

New England

(May 20)—BIANNUAL SYMPOSIUM ON COATINGS TECHNOLOGY—"Testing and Quality Control."

Piedmont

(May 18)—"SOLVENTS FOR HIGH SOLIDS COATINGS"—R. Readshaw, Union Carbide Corp.

(June 15)—"FINISHING POLYOLEFIN PLASTICS"—T.E. Parsons, Eastman Chemical Products, Inc.

St. Louis

(May 17)—"MANUFACTURING NIGHT."

FSCT Membership Anniversaries

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George A. Simmons, Georgia Marble Co.
Richard L. Smith, J.B. Smith, Inc.
Cornelius B. Thomas, Thomas Waterproof Coating.
William G. Welch, Alchemy-South Ltd.

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Eudowood Gardens, Towson, MD; Virginia Section—Fourth Wednesday, Ramada Inn-East, Williamsburg, VA). Section Secretary—Carl Minchew, Benjamin Moore & Co., West Roslyn Ave., Colonial Heights, VA 23824.

BIRMINGHAM (First Thursday—Westbourne Site, Edgbaston). D. H. Clement, Holden Surface Ctgs. Ltd., Bordesley Green Rd., Birmingham B9 4TQ, England.

CHICAGO (First Monday—meeting sites in various suburban locations). Fred Foote, U.S. Gypsum Co., 700 N. Rte. 45, Libertyville, IL 60048.

C-D-I-C (Second Monday—Sept., Jan., Apr., June in Columbus; Oct., Dec., Mar., May in Cincinnati; Nov., Feb., in Dayton). Robert A. Burtzlaff, Potter Paint Co. of Ind., P.O. Box 265, Cambridge City, IN 47327.

CLEVELAND (Third Tuesday—meeting sites vary). Ray Podlewski, Mansfield Paint Co., P.O. Box 998, Mansfield, OH 44901.

DALLAS (Thursday following second Wednesday—Steak & Ale Restaurant). T. Leon Everett, Dan-Tex Paint & Ctg. Mfg., Inc., P.O. Box 18045, Dallas, TX 75218.

DETROIT (Fourth Tuesday—meeting sites vary). Peter Burnett, Wyandotte Paint Products, Inc., 650 Stephenson Hwy., Troy, MI 48084.

GOLDEN GATE (Monday before third Wednesday—Alternate between Sabella's Restaurant on Fisherman's Wharf and the Sea Wolf at Jack London Square, San Francisco). Robert Miller, Frank W. Dunne Co., 1007 41st St., Oakland, CA 94608.

HOUSTON (Second Wednesday—Sonny Look's, Houston, TX) Richard D. Batchelor, Valspar Corp., 2503 W. 11th St., Houston, TX 77008.

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

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). Michael Gildon, Guardsman Chemicals, 9845 Miller Way, Southgate, CA 90280.

LOUISVILLE (Third Wednesday—Howard Johnson's, Louisville, KY). W. Jerry Morris, Celanese Plastics & Specialties Co., P.O. Box 99038, Jeffersontown, KY 40299.

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

MONTREAL (First Wednesday—Bill Wong's Restaurant). M. Megelas, International Paints Ltd., P.O. Box 190, Outremont, Que., Can., H2V 4M9.

NEW ENGLAND (Third Thursday—Fantasia Restaurant, Cambridge). Charles J. Hoar, Union Chemicals Div., 67 Walnut Ave., Clark, NJ 07066.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). Michael Iskowitz, Koppers Co., Inc., 480 Frelinghuysen Ave., Newark, NJ 07114.

NORTHWESTERN (Tuesday after first Monday—Boulevard Cafe, Golden Valley, MN). Robert Mady, George C. Brandt, Inc., 2975 Long Lake Rd., St. Paul, MN 55113.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). William Shackelford, Gaco-Western, Inc., P.O. Box 88698, Seattle, WA 98188.

PHILADELPHIA (Second Thursday—Valle's Steak House). William Georgov, J.M. Huber Corp., P.O. Box 310, Havre de Grace, MD 21078.

PIEDMONT (Third Wednesday—Howard Johnson's, Brentwood exit of I-85, High Point, NC.) James E. Husted, Mobil Chemical Co., P.O. Box 2438, High Point, NC 27261.

PITTSBURGH (First Monday—Skibo Hall, Carnegie Mellon Univ.). Clifford Schoff, PPG Industries, Inc., R&D Center, P.O. Box 9, Allison Park, PA 15101.

ROCKY MOUNTAIN (Monday following first Wednesday—Gusthaus Ridgeview, Lakewood, CO). Luis O. Garcia, Kelly-Moore Paint Co., 3600 E. 45th Ave., Denver, CO 80216.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant). William Truszkowski, Mozel Chemical Products Co., 4003 Park Ave., St. Louis, MO 63110.

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). R.H. Stevenson, Tenneco Chems., Canada Ltd., 235 Orenda Rd., Bramalea, Ont., Can., L6T 1E6.

WESTERN NEW YORK (Third Tuesday—The Red Mill, Clarence, NY). Donald M. Kressin, Spencer Kellogg Div., Textron, Inc., P.O. Box 210, Buffalo, NY 14225.

Elections

HOUSTON

Active

Unietis, Frank—AMF Tuboscope, Inc., Houston, TX.

Associate

Farber, Cheryl A.—Dow Corning Corp., Houston, TX.

LOS ANGELES

Active

Macias, Jim—McCloskey Varnish Co., Commerce, CA.

Sayta, Anil R.—Shiva, Inc., Torrance, CA.

Associate

Altenbern, Hal—Sherwin-Williams, Co., Los Angeles, CA.

Brushett, Wayne—Brushett-Garrows & Associates, Moorpark, CA.

Stella, Joseph P.—S. L. Abbot Co., Los Angeles, CA.

LOUISVILLE

Active

Elliott, Donald R.—United Catalyst, Inc., Louisville, KY.

Kosnik, Frank J. Jr.—Celanese Plastics & Specialties Co., Louisville.

Zamler, Brian Keith—Reliance Universal, Inc., Louisville.

Associate

Brewer, John B.—Lithocraft, Inc., New Albany, IN.

Brewer, Sam B.—Lithocraft, Inc., New Albany.

Frey, Sari R.—Noury Chemical Co., Birmingham, MI.

Hach, Wayne F.—Diamond Shamrock, Fairfield, OH.

O'Keefe, John J. Jr.—Mooney Chemicals, Inc., Cleveland, OH.

Wamelink, John—Borden Chemical Co., Brecksville, OH.

NEW YORK

Active

Aclin, John J.—Shamrock Chemicals Corp., Newark, NJ.

Brauer, Melvin—Caschem, Inc., Bayonne, NJ.

Browning, Robert J.—John L. Armitage & Co., Newark.

Edison, Michael P.—Edison Chemical Systems, Wolcott, CT.

Feld, Israel—Nuodex Inc., Piscataway, NJ.

Hasting, Danny K.—Whittaker Coatings, North Brunswick, NJ.

Kellerman, George—Kellermann Paint Co., New York, NY.

Mangravite, Angelo—Red Mills Paint & Chemicals, Jersey City, NJ.

Moraleda, Julianito—Debevoise Co., Brooklyn, NY.

Stone, Edward—United Tech (Inmont), Clifton, NJ.

Sudol, William—Shamrock Chemicals Corp., Newark.

Associate

Bell, Dean G.—Union Chemicals Div., Clark, NJ.

David, Richard W.—Sandoz Inc., E. Hanover, NJ.

Golden, Victor J.—Shamrock Chemicals Corp., Newark, NJ.

Hirschman, John C.—Englehard Minerals and Chemical Corp., Edison, NJ.

Janicki, David E.—Spencer Kellogg Div., Textron, Inc., Newark.

Maurer, John C.—Synergistic Pigments Corp., New Brunswick, NJ.

Retired

Singer, Herman J.—Cliffside Park, NJ.

NORTHWESTERN

Associate

Gates, William J.—Olin Chemicals, Oak Brook, IL.

Nemitz, Katherine A.—George Printing Co., Richfield, MN.

Schmidt, Mark H.—Mooney Chemicals, Inc., Palatine, IL.

Educator and Student

Jongewaard, Susan K.—Fargo, N.D.

PACIFIC NORTHWEST

Active

Hughes, Harry—Chemcentral, Portland.

Kijek, Greg—Rodda Paint Co., Portland, OR.

PHILADELPHIA

Associate

Recuber, William A.—Reliable-Nesco Inc., North Brunswick, NJ.

PIEDMONT

Associate

Cwik, Robert E.—Penn Color, Inc., Charlotte, NC.

SOUTHERN

Active

Boyle, Kevin J.—Crowe Industrial Coatings, Stone Mountain, GA.

Brown, Hector,—Alfa Enterprises, Inc., Miami, FL.

Kirlew, Charles W.—Production Chemicals, Inc., Coral Gables, FL.

Robinson, Greg—Robinson Chemical Ctgs., Meridian, MS.

Associate

Corlett, Thomas L.—DuPont de Nemours & Co., Memphis, TN.

Morris, Thomas A. III—Scholle Corp., Lilburn, GA.

ST LOUIS

Active

Donoff, Alex—King Adhesives Corp., St. Louis, MO.

Yadamec, Thomas—Carboline Co., St. Louis.

Associate

Mau, Thomas—Cargill, Inc., Carpentersville, IL.

Wagnon, Robert L.—Mozel Chemical Products Co., St. Louis, MO.

WESTERN NEW YORK

Active

Saad, Samy K.—Spencer Kellogg Div., Textron, Inc., Tonawanda, NY.

Retired

Kowalski, John B.—Amherst, NY.

Meetings/Education

Golden Gate Society Announces 'Conference '83', June 13

The Manufacturing Committee of the Golden Gate Society for Coatings Technology will sponsor "Conference '83—Paint Manufacturing Methods Update" June 13, at A. Sabella's Restaurant, Fisherman's Wharf, San Francisco, CA.

This all-day conference will concentrate on the latest methods of the use of equipment for dispersing, mixing, and blending of paints, inks, and varnishes. The program for the session will emphasize the latest techniques in handling and producing paints in the factory. The following presentations have been scheduled:

"Selecting Mills for Production"—Larry Sayre, The O'Brien Corp.

"Dispersing as of Today"—Fred Mooney, Mooney Machine Manufacturing Co.

"Media for Dispersing Type Mills"—Leo Dombrowski, Chicago Boiler.

"Dispersing Agents and How They Affect Productivity"—Wolfgang Zinnert, Byk-Mallinckrodt USA, Inc.

"Air Pallet Container as a Feed for Direct Closed Systems"—Avrom Handelman, Semi Bulk Systems.

"Overview of Pigments and Slurries in Paints"—Dave M. Touhill, Pfizer, Inc., MPM Div.

"Today's Colorant Dispensing and Color Matching Systems"—Don Tettemore, Grayco, Inc.

"Technology and Economics of In-Plant Tinting Colors"—Lorand Manhart, Tenneco Chemicals, Inc.

The evening program includes a panel discussion and workshop.

Registration fee of $45 includes lunch and dinner.

The conference staff consists of the following: *Chairman,* Louie Sanguinetti, Jasco Chemical Corp.; *Co-Chairman,* "Bud" Harmon, Borden Chemical Corp.; Richard Cooper, Harrisons & Crosfield; Bernie Brill, Union City Chemicals, Inc.; William Duncan, Ampex Corp.; Ted Favata, Triangle Paint Co., Inc.; Sandy Lund, Fuller O'Brien Corp.; Robert Miller, Frank W. Dunne Co.; Karl Sauer, Pfizer, Inc.; Leo Schinasi, Tenneco Chemicals, Inc.; Ken Trautwein, Sherwin-Williams Co.; and Ken White, Nalco Chemical Co.

For additional information, contact Louie Sanguinetti, Jasco Chemical Corp., P.O. Drawer J, Mountain View, CA 94042.

Chicago Society for Coatings Technology
1983 Grant-In-Aid

PURPOSE: To foster pursuit of a college education in the physical sciences by children of current members of the Chicago Society for Coatings Technology.

REQUIREMENTS:

(1) Applicant must be the son or daughter of a Chicago Society member.

(2) Society member must have current membership in Chicago Society for a minimum of two (2) years.

(3) Curricula which may be pursued by applicant: mathematics; computer sciences; chemistry/chemical engineering; physics; and engineering: mechanical, industrial.

(4) Any College or University offering an accredited four year program leading to a degree in one or more of the above curricula is acceptable.

(5) Grant-in-Aid for one year only, to be used in Academic year of award.

(6) Grant not renewable and non-transferable.

(7) Recipient of award must maintain full-time student status.

(8) Award to be paid directly to the college or university for application against tuition and fees.

(9) Alternate awardees will also be selected in the event the original awardee fails to maintain all the requirements stated above.

For additional information, contact Ray Cziczo, Glidden Coatings & Resins Div., SCM Corp., 1855 No. LeClaire Ave., Chicago, IL 60639.

26th Annual Conference Sponsored by Cleveland Society

The Education Committee of the Cleveland Society for Coatings Technology presented its 26th Annual Technical Conference entitled, "Advances in Coatings Technology," April 26–28, at the NASA Lewis Research Center, Cleveland, OH.

Under the direction of Chairman Richard R. Eley, of Glidden Coatings & Resins Div., SCM Corp., the Conference was divided into the following four symposia:

Advances in High Solids Coatings Technology

"Viscosity of Oligomer Solutions"—Zeno W. Wicks, Jr., North Dakota State University.

"Flow Control and Rheology of High Solids Coatings"—David R. Bauer, Ford Motor Co.

"Application Hardware and Techniques for High Solids Coatings. I: Can-Liner Coatings"—W.H. Cobbs, Jr., W.R. Rehman, and J.A. Kirchner, Nordson Corp.

"Case Histories of Chlorinated Compliance Coating Evaluations"—Carol K. Niemi, Dow Chemical USA.

Analysis of Coatings Cure

"Techniques to Measure Melamine/Polyol Reactions in a Film"—Michael G. Lazzara, E.I. duPont de Nemours & Co., Inc.

"Cure Characterization of Model and Organic Coatings Systems by FTIR and Thermal-Mechanical Analysis"—T. Provder, C. Kuo, C.M. Neag, G. Carlson, and R.M. Holsworth, Glidden Coatings & Resins Div., SCM Corp.

"FT-IR Studies of Chemical Reactions Occurring in the Surface Silane Coatings on Inorganic Oxides and Metal Substrates"—Hatsuo Ishida, Case Western Reserve University.

"Cryogenic Paint Stripping—An Advancement in Stripping Technology"—Scott A. Miller, Air Products and Chemicals, Inc.

Rheology and Coatings Application

"High Speed Wetting and Spreading on Polymeric Surfaces"—D.B. Pendergrass, 3M Corp., Magnetic A/V Div.

"Rheological Design of Water-Bourne Reverse-Roll Coating Systems"—T. Matsuda, W.H. Brendley, and W.M. Watson, Rohm and Haas Co., Inc.

"Effects of Surface Tension and Viscosity on Surface Defects in Coatings"—Clifford K. Schoff and Percy E. Pierce, PPG Industries, Inc.

"Rheology of Sterically Stabilized Dispersions"—Irvin M. Krieger, Case Western Reserve University.

High Technology Coatings And Analytical Methods

"Overview of NASA Lewis High Temperature Coatings Technology"—Stanley R. Levine, NASA.

"New Techniques for the Determination of Critical Pigment Volume Concentration of Latex Paints"—C. Peter Chiang and Thomas K. Rehfeldt, Sherwin-Williams Co.

"Spacecraft, Aircraft, and Missiles: Pushing the Limits of Coatings"—George F. Schmitt, Jr., Air Force Wright Aeronautical Laboratories.

"Stabilization of Pigment Dispersions by Absorbed Polymers"—Geoffrey D. Parfitt, Carnegie-Mellon University.

Southern Society to Mark Fiftieth Anniversary in 1984; Two Hundred and Twenty-five Attend 1983 Annual Meeting

The Southern Society for Coatings Technology will celebrate its 50th Anniversary at the March 7-9, 1984 meeting in Clearwater, FL. This was announced during the March 23-25, 1983 meeting in Memphis, TN, attended by 185 men and 45 women.

Theme of the 1983 meeting was "From Laboratory to Customer—Bridging the Gap Through Creativity." The program presentations were as follows:

Program

Keynote Address—"It Takes More Than Thinking to Be Creative"—Royal A. Brown, Technical Advisor to the FSCT.

"The Economics of Quality Trade Sales Paints"—Abel Banov, of the *American Paint Journal.*

"New Methods in Coatings Rheology"—Dr. Richard R. Eley, of Glidden Coatings and Resins. (Sponsored by the Paint Research Institute).

"Fire Safety in the Coatings Industry"—Melvin V. Harris, of Verlan Ltd.

"Microcomputers—No Arcade Games"—Craig Larson, of Chemical Specialties; Stanley Harshfield, of United Paint Co.; Joe Budash, of Scott Paint Corp.; and Jim Stanley, of Rico Chemicals, Inc.

"Applications of Industrial Coatings"—Bob Rodger, of Whittaker Corp.; Joe Lucas, of PPG Industries, Inc.; and Ken Close, of DeVilbiss Co.

"Latex-Water Reducible Blend Systems"—Ronald D. Bakule and Theodore A. Del Donno, of Rohm and Haas Co.

"Bunte Salts as Crosslinking Agents in Thermosetting Water-Borne Polymers"—Andrew Voda; and "Oligomers of Butadiene and Isoprene"—Dan Rogers. (Student papers from the University of Southern Mississippi).

Gadgets and Gimmicks

A Gadgets and Gimmicks competition was introduced and the entries were:

"Nigrosine as a Porosity Indicator"—Dan Adrien, of Burgess Pigment Co.

"A Rapid Method of Coating Samples for Quality Control Checks"—Harvey Leibowitz, of Associated Paints & Plastics.

"Dip Tank Stability Checker"—Stanley Harshfield, of United Paint Co.

"Variable Film Thickness Bird Film Applicator"—Harold Goslen, of Gilman Paint & Varnish Co.

"Thermometer Holder"—John Ballard, of Kurfees Paint Co.

Mr. Adrien's G&G was declared the winner. [*Some may be published in the JCT—Ed.*]

Business Meeting

Highlights of the annual business meeting were:

(1) Twenty-five members were declared eligible for 25-year pins: Edward B. Countryman, James Donnelly, Paul Eliot, George Erwin, William G. Ganswich, Harold Goslen, Robert F. Hall, Edwin Hill, William E. Hood, Howard Horton, Wayne Houck, Edwin Lowrey, Ernest C. McDonald, Robert B. McGoogan, R.S. McKenzie, Jr., Myer Price, W.E. Price, Frank A. Rideout, William Rose, Ronald L. Sadler, S.G. Sanfilippo, George A. Simmons, Richard L. Smith, Cornelius B. Thomas, and William G. Welch.

(2) By-Laws were passed establishing September 15 as the final date for receipt of annual membership dues.

(3) By-Laws were also approved changing the Officer Chairs from: President, President-Elect, Vice-President, and Secretary/Treasurer; to: President, Vice-President, Secretary, and Treasurer.

(4) The second "Consumer Guide to Trade Paint Quality—Latex Exterior Flat Paint" is being written by the Miami Section. (The first, "Latex Interior Flat Paint," was prepared by the Society in 1982 and published by the Federation).

(5) Average attendance at Section meetings during the past year were: Atlanta—50-60; Central Florida—35-50; Gulf Coast—20; and Memphis—40. No report from Miami.

(Continued on page 86)

Coatings Course Co-Sponsored By New York Society

A training course entitled, "Laboratory Course for Paint Technicians," has been co-sponsored by the New York Society for Coatings Technology and the New York Paint and Coatings Association this spring.

Designed for technicians who are employed in the coatings industry, the course combines basic theory, demonstrations, and laboratory exercises designed to broaden the knowledge and improve the skills of technicians with limited experience.

The session consists of a series of specific topics, each presented by an expert on the subject, and held at the laboratories of each lecturer's employer. The opportunity exists for the student to view the inside of many raw materials and coatings manufacturers' laboratories and to meet many of the prominent technical people in the industry.

Topics presented include: film formation and testing of film properties; hiding and extender pigments; dispersion and color pigments; color measurement and theory; rheology and viscosity measurement; emulsion and latex technology; and solvents.

Coordinator for the course is Jeffrey Kaye, of Maas & Waldstein Co., Newark, NJ.

LASCT Sponsors '83 Manufacturing Seminar

The Manufacturing Committee of the Los Angeles Society for Coatings Technology sponsored its '83 Manufacturing Seminar entitled, "Improving Dispersion Productivity," on April 13, in City of Commerce, CA.

Designed to benefit all production and technical personnel attempting to reduce production cost and improve production efficiency, the seminar presented the following topics:

"Wetting and Dispersion Agents"—Robert Vash, Byk-Mallinckrodt USA, Inc.

"Dispersers"—Jim White, Myers Engineering.

"Dispersing Media"—Ivan C. Quackenbush, Quackenbush Co., Inc.

"Mills"—Fred Rotar, Netzsch, Inc.; Gale Humphrey, Eiger Machinery; and Leo Dombrowski, Chicago Boiler.

"Factors Affecting Media Wear"—J.A. Grodzinski, S.C. Johnson & Son, Ltd.

Manufacturing Committee Members include: *Chairperson,* Anne Probizanski, AMPRO Technologies; Al Aronow, Sinclair Paint Co.; Lewis Ashworth, BAF Industries; Donald Bangle, Aztec Chemical, Inc.; Charles D. Catugno, McCloskey Varnish Co.; Laxmi C. Gupta, ARNCO; L. Lloyd Haanstra, Ameritone Paint Corp.; Romer Johnson, Dorsett & Jackson, Inc.; John G. Prinz, Sinclair Paint Co.; Al Seneker, Ameron Protective Coatings Div.; Carl Thompson, Durachrome Products; and Jan P. Van Zelm, Byk Mallinckrodt USA, Inc.

NPCA Sponsors Marine Coatings Conference

The 23rd Annual Marine and Offshore Coatings Conference entitled, "Anti-Fouling Coatings Development—A New Generation," was sponsored by the National Paint and Coatings Association May 11-13 at the Hyatt Regency Hotel, Baltimore, MD.

Following introductory remarks by Conference Chairman Joseph Harrington, of Ameron Protective Coatings, and Program Chairman, Armand Herreras, of Devoe Marine Coatings, the opening session featured the presentation, "U.S. Navy Anti-Fouling Coatings—State-of-the-Art," by Theodore Dowd, Engineering Dept. of the Navy Naval Sea Systems Command.

Walter H. Radut, of Exxon International Co.; Warren E. Stanford, of Gulf Science & Technology Co.; Svenn Dahl, of Norwegian-Carribbean Lines; and a representative from the U.S. Coast Guard participated in an afternoon panel discussion on "Shipowner Case Histories."

The second day of the conference featured a session on "Health and Safety Aspects of the Use of Anti-Foulings" which was moderated by Jay Shubrook, of Hempel's Marine Paints. Also participating in the session were Paul Shatzenberg, of U.S. Navy R&D, and a speaker representing M&T Chemicals. Rounding out the morning program was a session on the "Update of Toxicology and Environmental Impact of Advanced Anti-Foulings."

"Coatings Manufacturers' Update on Advanced Anti-Fouling" was moderated by Vicky Verbyla, of Seaguard Corp. Participating companies for the afternoon panel discussion included: Devoe Marine Coatings; Farboil Co.; Hempel's Marine Paints, Inc.; International Paint Co., Inc.; and Jotun Marine Coatings.

Friday, May 13 featured two workshops entitled: "Coatings Technology", chaired by Robert Doyle, of Ameron Protective Coatings Div. and John D. White of Devoe Marine Coatings Co.; and "Application Techniques."

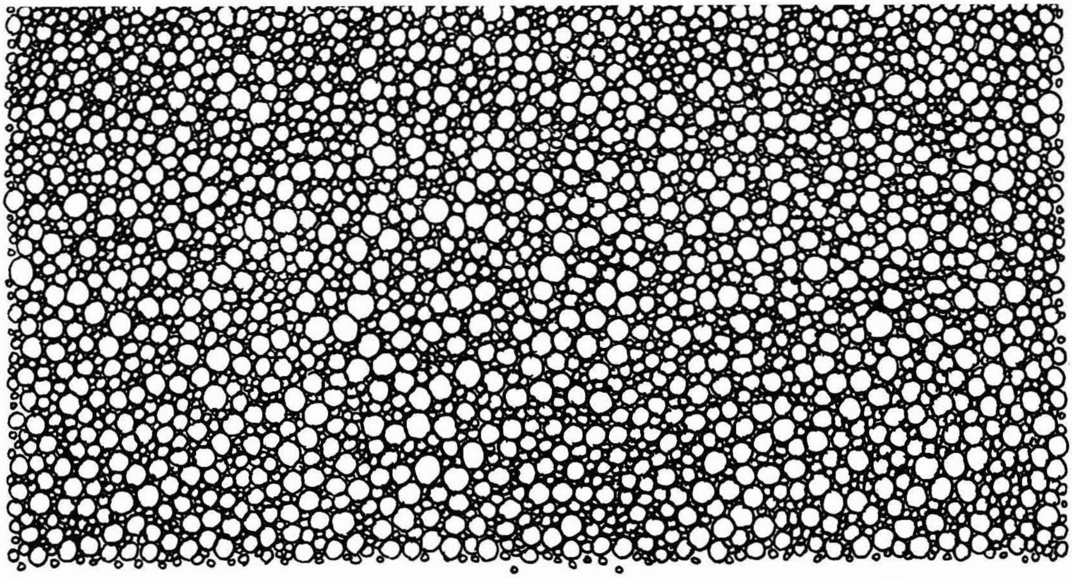
EMU Offers Master's Degree in Polymers and Coatings

An evening master's degree program in coatings and polymers and in related business has been announced by Dr. John C. Graham, Professor and Program Coordinator of Polymer and Coatings Technology at Eastern Michigan University, Ypsilanti, MI.

Designed for science graduates working in the polymers and coatings field, the program offers a formal education in polymers and coatings with additional courses concentrated in the business field. Participants will be able to use the program's information to assist them in their current assignments and to provide flexibility in the future.

The 30-semester hour program features graduate courses in polymer chemistry, coatings, business, management, marketing, and technology assessment.

More information about the program is available from Dr. John C. Graham, EMU, Ypsilanti, MI 48197.



UMR Offers 'Computer Programming for Coatings' May 23–26

"BASIC Microcomputer Programming for Coatings" course will be offered at the University of Missouri-Rolla, Rolla, MO, May 23-26.

The four-day session is designed for laboratory, purchasing, and marketing personnel who have a desire to utilize the computer as a tool to make their job faster, more efficient, and more productive. No prior programming experience is required.

Included in the course will be information about the types of computers; a background in computer hardware; number systems used by computers; and a review of high-level computer languages. The session will also provide the individual with programming techniques and design of a number of useful programs, including: sorting, information retrieval, cost of inventory, and paint formula bulking and costing.

Participants will learn how to write their own custom-designed software to be used on a microcomputer costing less than $2,000. From basic design to final working programs, utilizing the BASIC programming language, the individual will be able to obtain "hands-on" experience in programming. The programs written will be useful in formulation, information retrieval, purchasing, costing/pricing, sales analysis, and inventory control. These programs can be tailored to fit specialized needs, unlike many all-purpose packages available for more costly computers.

Lecturers for the session include: Stanley W. Harshfield, Technical Director, United Paint Co., Memphis, TN; James Stoffer, Associate Professor of Chemistry at UMR; and John A. Gordon, Jr., Director of Coatings Continuing Education and Lecturer in Chemistry at UMR.

Course registration fee is $600.

For additional information or to register, contact Norma Fleming, Arts & Sciences, Continuing Education, G7 H/SS, UMR, Rolla, MO 65401.

Southern Society Holds 1983 Annual Meeting

(Continued from page 84)

Luncheon

At the official luncheon on Friday, Society President Dan Dixon presented a $750 contribution to the Federation's Paint Research Institute. It was accepted by Federation President A. Clarke Boyce.

The guest speaker was Noris L. Johnston, of the Warren Rupp Co., whose motivational talk was entitled, "The Wings of Eagles."

Program Committee

In charge of the 1983 annual meeting program were: Terry Walsh, of the Kinsmen Corp.; Sal Sanfilippo, of Reichhold Chemicals, Inc.; John Dawson, of Kerr McGee Chemical Corp.; Phillip Aultman, of Alcan Ingots & Powders; Bob Link, of R.T. Vanderbilt Co.; Sheryl Neal Cobb, of Rico Chemicals, Inc.; Valerie Walsh Johnson, of Union Chemicals; Jeff Dore, of Ashland Chemical Co.; Bill Gleason, of Archway Chemical & Supply Co.; and Ken Haagenson, of Buckman Laboratories, Inc.

Outgoing Officers

Outgoing officers of the Society are: President—Dan M. Dixon of Freeport Kaolin Co.; President-Elect—William G. Early, of Piedmont Paint Mfg. Co.; Vice-President—Jim Geiger, of Sun Coatings Co.; Secretary/Treasurer—Sal Sanfilippo, of Reichhold Chemicals, Inc.; and Society Representative—Berger Justen, of Justen & Associates.

1983–84 Officers

As of May 1, the officers are: President—Mr. Early; Vice-President—Mr. Geiger; Secretary—Mr. Sanfilippo; Treasurer—Ronald Brown, of Union Chemicals Div.; and Society Representative—Mr. Justen.

KSU Schedules Adhesion Course, June 6–10

The Rheology and Coatings Laboratory of Kent State University's Chemistry Department will sponsor the short course entitled, "Adhesion Principles & Practice for Coatings and Polymer Scientists," June 6-10, at its campus in Kent, OH.

Designed to review adhesion principles, "Adhesion Principles & Practice for Coatings and Polymer Scientists" also discusses adhesion promoters, surface analysis and preparation, the rheology of application and fracture of joints, adhesion measurements, environmental effects on adhesive joints, and the science of structural, composite, plastic, and elastomer adhesives.

The following papers are scheduled:

Monday, June 6

"Principles of Bonding I"—Raymond R. Myers, KSU.

"Interfacial Energies and Their Role at the Interface"—Richard J. Ruch, KSU.

"Principles of Bonding II"—Raymond R. Myers.

"General Rheology and Its Application to Adhesion"—Donald L. Hunston, National Bureau of Standards.

Tuesday, June 7

"Viscoelastic Fracture of Joints"—Donald L. Hunston.

"Theory and Practice of Silane Adhesion Promoters"—Edward P. Plueddeman, Dow Corning Corp.

"Structure and Properties of Silane Primers for Adhesive Bonding of Iron, Titanium and Aluminum"—F. James Boerio, University of Cincinnati.

"Mechanisms of Paint Adhesion Loss"—Ray A. Dickie, Ford Motor Co.

Wednesday, June 8

"New Developments in Surface Analysis Instrumentation"—Thomas W. Rusch, Perkin Elmer Physical Electronics.

"Etching and Cleaning of Polymer Surfaces for Adhesive Bonding"—James Koutsky, University of Wisconsin.

"Spectroscopic and Thermodynamic Characterization of Polymer/Metal Adhesion"—J.J. Wightman, Virginia Polytechnic Institute and State University.

"I. The Effect of Water on Adhesive Bonding, II. Testing Adhesive Bonds"—Robert L. Patrick, Trebor Associates.

Thursday, June 9

"Principles of Adhesion Measurements"—Walter K. Asbeck, Consultant.

"Chemistry Physical Properties and Durability of Structural Adhesives"—Alphonsus Pocius, Minnesota Mining & Manufacturing Co.

"Matrix-Fiber Adhesion in Composites"—Lawrence T. Drzal, Air Force Materials Laboratory."

"Long Range Effects of Polymer Sorption and Its Relation to Adhesion"—Charles A. Kumins, Consulting Services.

Friday, June 10

"Bonding of Plastics and Elastomers I and II," Edward M. Petrie, Westinghouse Electric Corp.

Personnel in research and development interested in coatings, adhesives, inks, elastomers, and related areas would benefit from this course.

Additional details are available from Program Chairman Carl J. Knauss, KSU, Chemistry Dept., Kent, OH 44242.

People

John A. Gordon, Jr., Professor at the University of Missouri-Rolla, Rolla, MO, has been installed as Director to the Board of the Association of Finishing Processes of the Society of Manufacturing Engineers (AFP/SME) at its semiannual meeting, May 3.

Mr. Gordon is Director of Coatings Continuing Education at the University of Missouri-Rolla. He was formerly employed as Manager of Polymer Technical Services, AMSCO Div., of Union Oil Co. He received the B.A. Degree in Chemistry from San Diego State College in 1936. Past-President of the Los Angeles Society, he has served as Chairman of its Environmental Control, Program, Membership, and Publicity Committees. In addition, Mr. Gordon has served on the Federation's Finance, Environmental Control, Program, Publication, and Educational Committees.

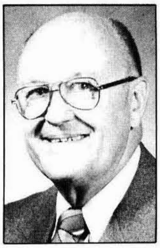
Emil Martin has been named Technical Manager, Product Quality in the PPG Industries, Coatings & Resins Div., Research and Development Center, Springdale, PA. He joined PPG in 1971 and is a member of the Pittsburgh Society.

Palmer Kalajian has retired from Inmont Corp., Hamtramck, MI, after 44 years with the company. Mr. Kalajian began his career there in 1939 as a clerk. After spending three and a half years in the Marines and two years at the College of the Pacific, he returned as an assistant in purchasing. He was named Plant Manager in 1964. Mr. Kalajian was, for many years, active in the Detroit Society.

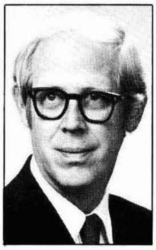
Materials Marketing Associates, Inc., (MMA), at its' annual meeting elected the following: President—**Howard McCullough,** of McCullough & Benton, Inc.; Vice-President—**James Boggess,** of William Tabler Co., Inc.; and Treasurer—**James Grierson,** of Apco Industries Co., Ltd. Mr. McCullough is a member of the Southern Society and Mr. Boggess is a Louisville Society member.

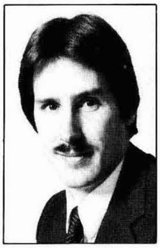
Serving on the Board of Directors for an additional year of their three-year terms are **Chan Withington,** of C. Withington Co., and **Donald Lukens,** of Lukens Chemical Co. Mr. Lukens is a member of the New England Society.

Also, **John Paul Taylor** will serve as Executive Director of the association.


J.A. Gordon, Jr.


E. Martin


W.R. Glaub


J.H. Maas

Wayne R. Glaub was named Director, Commercial Development, for the Johnson Wax Global Specialty Chemicals Group.

Robert H. McMullin, Technical Representative, has been transferred to the Dallas, TX area for Byk-Mallinckrodt USA Inc. He most recently served the metro-Chicago and Wisconsin areas. Mr. McMullin is a Dallas Society member.

Ken Tator, of KTA-Tator Associates, was presented with an award for outstanding service at the annual meeting of the Steel Structures Painting Council in Lake Buena Vista, FL. Mr. Tator was presented with a Certificate of Recognition for his leadership on the Research Committee of the SSPC, which he has chaired since 1977. The Research Committee during his tenure participated in developing new and revised SSPC specifications and guides for paints, painting systems, surface preparation, paint application, and safety. Mr. Tator is a member of the Pittsburgh Society.

Thomas Drucker has been named Vice-President, Technical Director, of Graham Paint & Varnish Co., Inc., Chicago, IL. He is a member of the Chicago Society.

Vanex Color, Mt. Vernon, IL, has named **Kenneth E. Brandt,** Vice-President of Manufacturing. Mr. Brandt is a St. Louis Society member.

Commercial Coatings Corp., Miami, FL, has announced that **Jack Benham** has joined the firm as Technical Director. Mr. Benham is a Past-President of the Miami Section of the Southern Society and the FPCA.

Joseph H. Maas has been appointed Commercial Development Manager for NL Chemicals/NL Industries, Inc., Hightstown, NJ.

Juliette D. Benedicto has been appointed Associate Director, Management Information, in the Industry and Government Affairs Div., of the National Paint and Coatings Association. She succeeds **Everett R. Call,** who has retired from the association to head the Color Marketing Group.

Also, **Robert D. Foreman** has joined the staff of NPCA as Assistant Director, legislative affairs, in the Association's Industry and Government Affairs Div. Mr. Foreman, who will coordinate NPCA's state legislative affairs programs, has held numerous positions on Congressional staffs.

Dr. Ronald D. Bakule and **Dr. Theodore A. DelDonno,** of Rohm and Haas Co., Philadelphia, PA, were presented with the Elias Singer Award for Best Paper at the Waterborne and Higher-Solids Coatings Symposium in New Orleans, LA. The award, given by Troy Chemical Corp., Inc., Newark, NJ, which consists of a plaque and $500, was presented for the authors' paper on "Latex-Water Reducible Blend System."

Philip G. Irwin has been named Project Manager for tall oil and specialty chemicals at Georgia-Pacific.

Mooney Chemicals, Inc., Cleveland, OH, has announced the appointment of **Michael J. Maximovich** to its technical staff where his initial assignment is in the development of water-reducible fungicides and additives.

Dr. Eugene M. Allen, Lehigh University Emeritus Professor of Chemistry and former Director of the Color Science Laboratory in the university's Center for Surface and Coatings Research, has been named the 1983 recipient of the Godlove Award, presented by the national Inter-Society Color Council.

Dr. Allen, a member of the Lehigh faculty from 1967 until his retirement in 1982, was honored by the Society for his "contributions to the advancement of the science of color."

A published authority in the fields of color science, radiant energy, and microprobe spectroscopy, Dr. Allen has conducted research at Lehigh and in consultations with companies in the United States and abroad.

In 1982, Dr. Allen was honored with the Federation of Societies for Coatings Technology's Armin J. Bruning Award for his outstanding contributions to the science of color in the field of coatings technology.

Nalco Chemical Co., Oak Brook, IL, has announced the promotion of **Charles R. Watts** to Regional Sales Manager of the Southwest Region in the Water Treatment Chemicals Group. Mr. Watts previously served as District Manager.

John S. Dumble has been promoted to the newly created position of Executive Vice-President of Glidden Coatings & Resins Div., SCM Corp. He is responsible for all domestic marketing of coatings and related products segregated into three business units: trades sales, chemical coatings, and macco adhesives.

Sun Chemical Corp. has announced the appointment of **Dr. Theodore Sulzberg** to the new position of Applications Research Manager at its corporate research laboratory, Carlstadt, NJ.

The Industrial Coatings Div. of H.B. Fuller Co., St. Paul, MN, has named **Larry W. Cecil** as Appliance Industry Specialist.

Lilly Industrial Coatings has named **Robert S. Bailey** Vice-President, General Sales Manager.

The Dryvit System, Inc. has named **John V. Patrick** to the position of Director of Research and Development.

Michael A. Kolakowski has been named Manager of Engineering of Cas-Chem, Inc., Bayonne, NJ.

Dr. Janos Schulze has been appointed Manager of the Technical Development and Service Laboratories of the Pigments Dept., CIBA-GEIGY Corp. Under Dr. Schulze's direction, the department's technical services laboratories in Glens Falls, New York, and Ardsley, NY have been consolidated at the corporate headquarters in Ardsley.

James D. Stalder has been promoted to Sales Manager—Metal Coatings for the Coatings Div. of Ferro Corp., Cleveland, OH.

William F. Murphy has been appointed Vice-President, Marketing, Petrochemical Group, for the Union Chemical Div., Union Oil Co. of California. Also, **Fred S. Bartholomew** was named General Manager, Marketing, for the Group.

The Mearl Corp., New York, NY, has announced the promotion of **William R. Lawson** to the position of Technical Sales Representative in the New York/New Jersey area. Mr. Lawson formerly served as Director of one of the firm's customer service laboratories.

Draiswerke, Inc., Allendale, NJ, has announced the appointment of **Richard G. Barbini** to its technical sales staff. As Sales Manager, Mr. Barbini is responsible for sales and marketing of the firm's product lines.

Norman F. Ottley has been elected a Vice-President of Witco Chemical Corp. and General Manager of its Organics Div. He succeeds **Alfred P. Marone,** who has retired after 30 years of service to the firm.

Jay R. Olson, former President and Chief Operating Officer of GAF Corp., has been elected a Corporate Executive Vice-President and Chief Financial Officer of Reichhold Chemicals, Inc., White Plains, NY.

The Board of Directors of Reichard-Coulston, Inc., New York, NY, has announced the election of **John M. (Mike) Coulston** as President and Chief Executive Officer, and of **John B. Coulston** as Chairman of the board.

Frank E. Purcell, Jr. has been named Manager of Distributors for Union Carbide Corp., Danbury, CT. He succeeds **Merritt A. Bigelow, Jr.,** who has retired after 38 years with the firm.

Ameritone Paint Corp., a member of Grow Group, Inc., Long Beach, CA, has announced two new appointments within its marketing department. **Roland Jenkins** has been appointed Northern Regional Manager, responsible for sales in Northern California, Washington, Oregon, and Northern Nevada. **Dan Gonzalez** was promoted to Southern Regional Manager, responsible for sales in Southern California, Arizona, and Southern Nevada. He previously served as a territory salesman.

Two top-level changes in communications management at the Chemical Manufacturers Association have been announced. **Jon C. Holtzman** has been named Vice-President of Communications, and **Richard L. Wilson,** former Vice-President of Communications, has been appointed Director of Public Relations and Advertising.

Obituary

Edwin V. Ladd, President of the Federation in 1937–38, died on January 29.

Mr. Ladd earned a B.Sc. degree in 1922 from the North Dakota State Agricultural College and then joined the Glidden Co., Cleveland, OH, where he eventually served as manager of lacquer production. In 1930, Mr. Ladd joined the Densol Paint Co., South Park, OH, where he was placed in charge of production, serving as chemist, superintendent, and member of the Board. Prior to serving as Federation President, Mr. Ladd was active in the Cleveland Production Club, serving as its treasurer, secretary, vice-president and president. He also served the Federation as Vice-President and Chairman of its Plant Managers' Committee.

Chester Arthur Olson, 69, retired Manager for Hanna Chemical Coatings, died on February 20, in Birmingham, AL. Mr. Olson was the 1957–58 President of the C-D-I-C Society. He was also a member of the American Chemical Society.

Ignatius Metil, of IMCO Laboratories, Inc., Buffalo, NY, died on March 11. Mr. Metil was also a consultant and active in Committee D-1 of ASTM. He was a member of the Western New York Society.

Literature

MultiScale

Two new full-color brochures detailing the capabilities, features, and specifications of the MultiScale are now available. A six-page brochure lists actual industrial weighing problems and how they have been solved by the MultiScale. A summary of weighing platforms and accessories, plus capacities and readabilities, is given. Details on how the user can easily expand the system to obtain printed records of results or interface the system to a computer are featured. A second brochure deals with counting procedures and explains how significant savings can be achieved. Also included is a chart summarizing the various weighing platforms with their respective capacities and readabilities. Copies of the brochure can be obtained from Mettler Instrument Corp., Box 71, Hightstown, NJ 08520.

Catalyst Analyzer

Information is available on a completely automated instrument that permits evaluation of catalyst surface activity at every stage of a catalyst life, from development and manufacturing to quality control and recovery. Advantages and application uses of the Chemisorb 2800 are detailed. For information, contact Micromeritics Instrument Corp., 5680 Goshen Springs Rd., Norcross, GA 30093.

Lumpbreakers

A data sheet is available featuring new lumpbreakers which are direct driven accessories for the new Mark II conical mixers. Advantages of using the lumpbreakers are listed and application uses are detailed. For information, contact Day Mixing Co., 4932 Beech St., Cincinnati, OH 45212.

Spectrocolorimeter

Literature is available introducing the CompuScan spectrocolorimeter which is designed to measure the reflected color of objects, and through a standard communications port, interfaces directly with a customer's computer, thus eliminating the need for programming keyboards and data display. Performance characteristics, design, and features of the spectrocolorimeter are detailed. For information, write HunterLab, Hunter Associates Laboratory, Inc., 11495 Sunset Hills Rd., Reston, VA 22090.

Oxygen Analyzer/Alarm

Literature is available featuring a sequencing oxygen analyzer/alarm designed to monitor oxygen concentrations. For further information, write Neutronics, Inc., 450 Drew Court, King of Prussia, PA 19406.

Color Dispersions

Literature is available featuring olive drab color dispersions for military camouflage coatings. Formulations and colorants are detailed. For information, contact Pigment Dispersions Inc., 54 Kellogg Court, Edison, NJ 08817.

Adhesive Emulsion

A brochure is available which features a new polyvinyl acetate emulsion developed for use in the formulation of remoistenable adhesives for envelopes, labels, stamps, and tapes. For additional information, contact the Organic Chemicals Div., W. R. Grace & Co., 55 Hayden Ave., Lexington, MA 02173.

Black

Information has been published on a new standard black for architectural coatings which is significantly stronger tinctorially than traditional tinting black dispersions. For information, contact The Hilton-Davis Chemical Group, Pigments Dept., P.O. Box 37869, Cincinnati, OH 45222.

Exposure System

A new HPUV indoor actinic exposure system used to monitor color stability of materials exposed to typical office/store lighting is the subject of recently published literature. Complete information is available from Atlas Electric Devices Co., Chicago, IL 60613.

Color System

A visual color system which offers the state of the art in color creation, visual color matching, and communication is featured in new literature. For information, write Applied Color Systems, Inc., Princeton Service Center, U.S. Highway One, P.O. Box 5800, Princeton, NJ 08540.

Probe System

Literature is introducing a new beta-backscatter probe system specifically designed to quickly and easily measure gold, copper, tin-lead, photoresist, and other coatings on printed wiring boards. Contact UPA Technology, Inc., 60 Oak Dr., Syosset, NY 11791 for information.

Vapor Monitoring System

Information is available on a catalytic combustible gas detection system with drawn sample sensor for continuous measurement of flammable vapors. For information, contact R. J. R. Archer, Inc., Div. of R. J. Reynolds Development Co., Winston-Salem, NC.

pH Instruments

A new 20-page brochure offers a complete description on pH meters, electrodes, and accessories. Information is provided on digital tall meters, portables, and analog devices designed for most laboratory, industry, and field uses. Featured is a section which matches the type of meter and electrode needed for various common applications. Write Corning Science Products Dept., MP-21-5, Corning Glass Works, Corning, NY 14831 for the free brochure.

Solvents

A new brochure entitled, "Dow's Powerful Trichloroethylene Solvents," which contains 13 pages of technical information on four grades of trichloroethylene, can now be obtained. Data on each of the four solvents is discussed, including health and handling procedures, production and distribution of the solvents, and environmental factors. For copies of the literature, write Susan King, Inquiry Correspondent, Inorganic Chemicals, Dow Chemical U.S.A., 1703 S. Saginaw Rd., Midland, MI 48640.

Plasticizer

A six-page booklet describing FLEXOL Plasticizer EPO, an epoxidized soybean oil used as a polymeric plasticizer and auxiliary vinyl stabilizer, is now available. Application uses are listed, as are functions, regulations, and properties of EPO. Copies of "FLEXOL Plasticizer EPO," designated F-49584, can be obtained from Union Carbide Corp., Specialty Polymers and Composites Div., Dept. M1553, Danbury, CT 06817.

Finishes Guide

A guide to the available coatings and their methods of application to aid the designer, engineer, and others responsible for specifying finishes has recently been published. "Guide to the Selection and Use of Electroplated and Related Finishes" discusses and defines electroplating as one of the methods of producing finish coatings on metals. Cost of the guide is $9.00. Additional information is available from ASTM, Sales Services Dept., 1916 Race St., Philadelphia, PA 19103.

Standards

The 1983 edition of the *Catalog of American National Standards* has been published and is now available. The 192-page catalog lists all current American National Standards Institute-approved standards which establish dimensions, ratings, terminology and symbols, test methods, and performance and safety requirements for materials, equipment, and products. Institute members and libraries can receive the catalog and its supplements free. Nonmembers may obtain a copy for $10 from ANSI, Inc., 1430 Broadway, New York, NY 10018.

Alkyd Resin

A high solid oil-free alkyd resin for use by coating manufacturers in formulating clear finishes and one-coat enamels for a variety of industrial applications is described in a new bulletin. Included are its specifications, typical reduction curves, effects of solvents on viscosity and stability, and useful advantages. The literature is available from Reichhold Chemicals, Inc., 525 N. Broadway, White Plains, NY 10603.

Membrane

A four-page color brochure detailing an advanced membrane configuration for new and existing electrocoat paint recovery installations has been published. Outlined in the literature are design benefits, increases in performance, and approximate permeate rates of the tubular membrane for both anionic and cationic paint. Request brochure AA/BR—82-12 from Abcor, Inc., 850 Main St., Wilmington, MA 01887.

Epoxy Resin

A new water-borne epoxy resin developed for coatings applications has been introduced in recently published literature. Application uses are discussed which include its use in product finishes for metal building, certain drum linings, aluminum coil coatings, and major appliances. Regulations and economics regarding the use of water-borne versus solvent-borne painting systems are detailed. Product performance information is highlighted. For a copy of the literature, contact Celanese Specialty Resins, P.O. Box 37600, Louisville, KY 40233.

Specialty Polymers

"Specialty Polymers, II" is the subject of a new techno-economic multi-client study by Skeist Laboratories, Inc. The study, an expanded study of their 1975 study, encompasses over 120 polymers, both addition and condensation type. Technological aspects are explored in detail to illuminate the key characteristics and commercial developments for each material. A section is also devoted to new precursors and polymers which are not yet commercial, but show promise of attaining that status. Applications by form and by end-use market is also discussed. A free brochure is available from Skeist Laboratories, Inc., 112 Naylon Ave., Livingston, NJ 07039.

Dyes

Literature is available featuring polycron dianix dyes with high lightfastness for the dyeing of polyester, especially in the automotive and upholstery industries. Information can be obtained from Atlantic Chemical Corp., P.O. Box 216, Nutley, NJ 07110.

Colorimeter

A colorimeter for non-continuous use in process control is the subject of new literature. Information is provided on the colorimeter's design for the examination of paint and related surface coatings. Contact Sheen Instruments Ltd., 9 Sheendale Rd., Richmond, Surrey, TW9 2JL.

Pigment

A new lower oil absorption, finer particle size anticorrosive pigment that is an effective, environmentally acceptable alternative to lead and chromate pigments is featured in recent literature. Uses of the pigment are detailed which include in both water and solvent based formulations for applications such as maintenance coatings, coil, machinery and equipment coatings and automotive protective coatings. Formulation benefits and performance characteristics are discussed. Contact NL Chemicals/NL Industries, Inc., Box 700, Hightstown, NJ 08520 for more information.

Consistometer

Information is available featuring a consistometer which is capable of making rapid determinations of the consistency of highly viscous materials. Application uses of the unit are detailed which include use in the paint industry for use on paint removers for epoxy and polyurethane paint systems. For information, contact CSC Scientific Co., Inc., 2600 S. Kostner Ave., Chicago, IL 60623.

Dew Point Meter

Information has been published featuring a dew point meter ideal for relative humidity measurement under static air conditions and in small enclosures, and for immersion of the sensor in products for measurement of equilibrium relative humidity. The eight-page catalog provides photos of four sensor styles and several meter styles. Additional data is included on a humidity and temperature indicator/controller. Application uses are also listed. Contact Clifford Bates, Cosa Instrument Corp., 70 Oak St., Norwood, NJ 07648 for additional information.

Viscosity Measurement

"Technical Papers on Viscosity Measurement and Control", a new catalog of contemporary rheological literature, is being offered. Reprints of 72 titles and summaries are listed, as are 11 catagories covering foods, paints, and coatings, biological fluids, and thick film inks. For a free copy of the catalog, contact Brookfield Engineering Laboratories, Inc., Dept. NR 42, 240 Cushing St., Stoughton, MA 02072.

Brushes

Product information on a wide variety of industrial power-driven brushes, maintenance brushes, and professional paint application tools is contained in a new 62-page catalog. The literature provides general information and technical data on numerous products in each category. Photographs illustrate examples of all types of brushes and selected application uses. "Catalog FW, Industrial Brushes, Power Drive Brushes, Paint Brushes and Roller's, Maintenance Brushes," may be obtained by writing PPG Industries, Inc., 10 North, One Gateway Center, Pittsburgh, PA 15222.

Copolymer

A new vinyl-acrylic copolymer designed to provide improved architectural coatings performance has been introduced in literature. Interior and exterior paint formulation suggestions are discussed as are recommended uses. For information, contact Union Carbide Corp., Solvents & Coatings Materials Div., Dept. K3442, Danbury, CT 06817.

Solvent

A urethane-grade organic solvent for use by the paint and coatings industry is the subject of recent literature. Performance characteristics of propylene glycol methyl ether acetate (PMA) are discussed. Contact Dow Chemical Co., Midland, MI 48640 for information.

Waste Exchange Listings

The Northeast Waste Exchange has announced availability of its newly updated *Listings Catalog,* which contains over 275 waste listings and is designed to put waste generators in touch with waste users.

Listings for "Materials Available" and "Materials Wanted" are accepted for a $25 fee and are published in the catalog for a year. Each listing receives a confidential code number; inquiries about a specific waste listing are then forwarded by the Exchange to the company placing the request. The firm chooses the respondents with whom it may wish to negotiate. The Exchange does not participate in any negotiations. Only the staff managing the daily activities of the Exchange has access to the index relating code numbers to company names.

Free copies of the *Listings Catalog* and information about listing a waste may be obtained by contacting: Walker Banning, Northeast Waste Exchange, 700 E. Water St., Room 711, Syracuse, NY 13210.

CLASSIFIED ADVERTISING

Sales Reps
Industrial Coatings

Expd coating reps or stocking reps needed by a leading mfr of electrical/mechanical shielding materials. Paints and coatings sold to the electronic and computer companies as well as plastic molders. Very hot line and most territories open. Established accounts will be turned over. Exclusive territory arrangement.

If interested, please send company profile, Re: lines carried, territories covered, number of personnel, etc. to: Vice President, P.O. Box 1404, New Haven, Conn. 06505.

Technical Sales

Leading Agent/Distributor in the New York/Philadelphia area with offices throughout the United States requires technically oriented sales person with proven background in chemical sales to the plastic, coatings and rubber industry. Products involved showed substantial sales increases during 1982. Candidate should have B.S. degree in Chemistry with 3–5 years sales experience. Company benefits include car, medical, dental insurance and pension plan. Salary commensurate with experience. Reply to: JCT, Box 317.

Coming Events

FEDERATION MEETINGS

(May 19–20)—Spring Meetings. Society Officers on 19th; Board of Directors on 20th. Terrace Hilton Hotel, Cincinnati, OH. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(Oct. 12–14)—61st Annual Meeting and 48th Paint Industries' Show. Place Bonaventure, Montreal, Quebec, Canada. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

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

(June 3)—Virginia Section of Baltimore Society Seminar. "Regulations Update for the Paint Industry. Williamsburg, VA. (Colin Penny, Hampton Paint Mfg. Co., P.O. Drawer E, Hampton, VA 23369).

(June 10–11)—Joint meeting of Kansas City and St. Louis Societies. Holiday Inn, Lake of the Ozarks, MO.

(June 13)—Golden Gate Society for Coatings Technology. Manufacturing Committee Symposium on "Paint Manufacturing Methods Update." (Louie Sanguinetti, Jasco Chemical Co., P.O. Drawer J. Mountain View, CA 94042).

1984

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

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

1985

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

OTHER ORGANIZATIONS

(May 16–19)—"Marine Painting and Surface Preparation" Short Course. Norfolk, VA. (Carmen Rivera, Institute of Applied Technology, P.O. Box 32331, Washington, DC 20007).

(May 16–20)—"Dispersion of Pigments and Resins in Fluid Media" Short Course. Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State University, Kent, OH 44242).

(May 18–19)—"Electrocoat Training Seminar." ABCOR, Inc., Wilmington, MA. (Jim Allshouse, ABCOR, Inc., 850 Main St., Wilmington, MA 01887).

(May 19–20)—"Fundamentals of Color" Seminar. Cherry Hill, NJ. (Jeanne M. Dolan, Macbeth, Div. of Kollmorgen Corp., Little Britain Rd., P.O. Box 950, Newburgh, NY 12550).

(May 23–25)—ASTM D-33 Coatings for Power Generation Facilities Committee Meeting. Galt House, Louisville, KY. (Phil Lively, ASTM, 1916 Race St., Philadelphia, PA 19103).

(May 23–26)—"BASIC Microcomputer Programming for Coatings" Short Course. University of Missouri-Rolla, Rolla, MO. (Norma Fleming, Arts & Sciences, Continuing Education, G7 H/SS, UMR, Rolla, MO 65401).

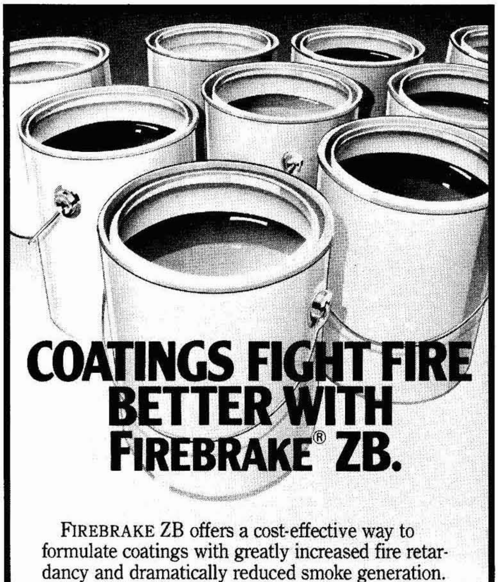
(May 23–27)—"Colloids and Interfaces" Seminar. Carnegie-Mellon University, Pittsburgh, PA. (Frank E. Nowak, Director of Post College Professional Education, 405 MMCH, Carnegie-Mellon University, Pittsburgh, PA 15213.

(May 24–26)—8th Annual Powder and Bulk Solids Conference/Exhibition. Georgia World Congress Center, Atlanta, GA. (Cahners Exposition Group, Cahners Plaza, 1350 E. Touhy Ave., Des Plaines, IL 60018).

(June 1–2)—"Color Technology for Management" Course. Rochester Institute of Technology, Rochester, NY. (Val Johnson, T&E Center Seminar Coordinator, Rochester Institute of Technology, P.O. Box 9887, Rochester, NY 14623).

(June 2–3)—"Fundamentals of Color" Seminar. Rosemont, IL. (Jeanne M. Dolan, Macbeth, Div. of Kollmorgen Corp., Little Britain Rd., P.O. Box 950, Newburgh, NY 12550).

(June 6–10)—"Adhesion Principles and Practice for Coatings and Polymer Scientists" Short Course. Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State University, Kent, OH 44242).



(June 6–10)—"Advances in Emulsion Polymerization and Latex Technology" Short Course. Lehigh University, Bethlehem, PA. (Dr. Mohamed S. El-Aasser, Dept. of Chemical Engineering, Sinclair Lab #7, Lehigh University, Bethlehem, PA 18015).

(June 6–10 & 13–17)—"Principles of Color Technology" Course. Rochester Institute of Technology, Rochester, NY. (Val Johnson, T&E Center Seminar Coordinator, Rochester Institute of Technology, P.O. Box 9887, Rochester, NY 14623).

(June 15–18)—Oil & Colour Chemists' Association Biennial Conference on "The Efficient Use of Surface Coatings." Viking Hotel, York, England. (R.H. Hamblin, Director and Secretary, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, HAO 2SF, England).

(June 19–22)—Dry Color Manufacturers' Association Annual Meeting. The Greenbrier, White Sulphur Springs, WV. (P.J. Lehr, DCMA, Suite 100, 117 N. 19th St., Arlington, VA 22209).

(June 20–24)—"Advances in Color Technology" Course. Rochester Institute of Technology, Rochester, NY. (Val Johnson, T&E Center Seminar Coordinator, Rochester Institute of Technology, P.O. Box 9887, Rochester, NY 14623).

(June 20–24)—"Applied Rheology for Industrial Chemists" Short Course. Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State University, Kent, OH 44242).

(June 20–24)—"Films and Coatings for Technology" Short Course. Palace Hotel, Zandvoort, The Netherlands. (The Continuing Education Institute, Europe [CEI-Europe], Gustav Adolfsgatan 9, S-582 20 Linkoping, Sweden).

(June 20–24)—"Printing Inks and Printing Processes" Short Course. Lehigh University, Bethlehem, PA. (Dr. Mohamed S. El-Aasser, Dept. of Chemical Engineering, Sinclair Lab #7, Lehigh University, Bethlehem, PA 18015).

(June 26–27)—ASTM Committee E-12 on Appearance of Materials Meeting. Hyatt Regency Nashville, TN. (Bob Morgan, ASTM, 1916 Race St., Philadelphia, PA 19103).

(June 26–29)—ASTM Committee D-1 on Paint and Related Coatings and Materials Meeting. Hyatt Regency Nashville, Nashville, TN. (Phil Lively, ASTM, 1916 Race St., Philadelphia, PA 19103).

(June 26–30)—70th Annual Technical Conference and Exhibit, "SUR/FIN '83," sponsored by the American Electroplaters' Society. Indiana Convention-Exposition Center, Indianapolis, IN. (*Co-Chairmen:* Paul Johnson, Guide Div., GMC, 2915 Pendleton, Anderson, IN 46011; Richard Watson, Benchmark, Inc., 5256 N. Tacoma Ave., Suite 9, Indianapolis, IN 46220).

(July 25–29)—"Microbiological Degradation" sponsored by the Gordon Research Conferences. Brewster Academy, Wolfeboro, NH. (Alexander M. Cruickshank, Director, Gordon Research Conferences, University of Rhode Island, Kingston, RI 02881).

(Aug. 8–12)—"Physics and Chemistry of Coatings and Films" sponsored by the Gordon Research Conferences. Plymouth State College, Plymouth, NH. (Alexander M. Cruickshank, Director, Gordon Research Conferences, University of Rhode Island, Kingston, RI 02881).

(Aug. 15–19)—"Advances in Emulsion Polymerization and Latex Technology" Short Course. Schatzalp Berghotel, Davos, Switzerland. (Dr. Gary Poehlein, School of Chemical Engineering, Georgia Institute of Technology, Atlanta, GA 30332).

(Aug. 26–30)—International Colour Association's Forsius Symposium on Colour Systems. Kungalv, Sweden. (Fred W. Billmeyer, Jr., Dept. of Chemistry, MRC 217, Rensselaer Polytechnic Institute, Troy, NY 12181).

(Aug. 31–Sept. 8)—20th Commission Internationale de l'Eclairage Congress. RAI Congress Center, Amsterdam, The Netherlands. (U.S. National Committee, CIE, c/o National Bureau of Standards, Washington, D.C. 20034).

(Sept. 18–20)—Canadian Paint and Coatings Association's 71st Annual Convention. Hyatt Regency Hotel, Montreal, Quebec, Canada. (CPCA, 515 St. Catherine St. W., Suite 825, Montreal, Quebec H3B 1B4, Canada).

(Sept. 27–28)—Pulp Chemicals Association's 11th International Naval Stores Conference and Technical Symposium. Westin Peachtree Plaza Hotel, Atlanta, GA. (Pulp Chemicals Association, 60 E. 42nd St., New York, NY 10165).

(Sept. 27–30)—National Coil Coaters Association Fall Technical Meeting. Hyatt Regency O'Hare, Chicago, IL. (NCCA, 1900 Arch St., Philadelphia, PA 19103).

(Sept. 28–Oct. 1)—Oil & Colour Chemists' Association's Silver Jubilee Convention and Exhibition. Southern Cross Hotel, Melbourne, Australia. (O.C.C.A.A., 1983 Pacific Coatings Convention, C/- Tioxide Australis Pty. Ltd., Private Bag 13, Ascot Vale, Victoria, 3032, Australia).

(Oct. 5–6)—"Finishing of Plastics for Functional and Decorative Purposes" Technical Conference. Decorating Division of the Society of Plastics Engineers. Hyatt Regency, Cherry Hill, NJ. (Ed Stumpek, General Electric, One Plastics Ave., Pittsfield, MA 01201).

(Oct. 11–13)—"Finishing '83" sponsored by the Association for Finishing Processes of the Society of Manufacturing Engineers. Cincinnati Convention Center, Cincinnati, OH. (Susan Buhr, AFP/SME Administrator, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

(Nov. 2–3)—3rd World Congress on Coatings Systems for Bridges and Steel Structures. Breckenridge Concourse Hotel, St. Louis, MO. (John A. Gordon, Jr., Conference Director, Arts & Sciences, Continuing Education, University of Missouri-Rolla, Rolla, MO. 65401).

(Nov. 2–3)—Resins and Pigments Exhibition. Europa Hotel. London, England. (Polymers, Paints & Colour Journal, Queensway House, Redhill, Surrey, RH1 1QS, England).

(Nov. 2–4)—"Fundamentals of Adhesion: Theory, Practice, and Applications" Short Course. State University of New York, New Paltz, NY. (Dr. Angelos V. Patsis, Chemistry Dept., SUNY, New Paltz, NY 12561).

(Nov. 11–13)—36th National Decorating Products Show. McCormick Place, Chicago, IL. (NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132).

Advertisers Index

'Humbug' from Hillman

It was a pleasure to hear from my faithful friends—Russ Horne and Howard Jerome. Notes from one new contributor, Maureen Lein, also found there way to Humbug's Vermont Nest.

Russ Horne, of Pen Painter, must of had his problems over the years to arrive at the following dependable set of laws.

Horne's Law of Paint Manufacturing

1. No matter how well a paint is formulated and perfected in the laboratory, it is always a complete disaster when manufactured in the plant until it does not in any way resemble the original recipe.
2. Poor quality formulas always come out exactly in production.
3. If there is only - and only - one way to screw-up a formula, it is always found by the most experienced operator at the most critical point when sales needed it yesterday.
4. The number of each batch adjustments increase geometrically in proportion to the number of ingredients in the batch.
5. The most unlikely stable and consistant raw materials are the causes for manufacturing problems.
6. Equipment failures always occur in production when batches are at critical stages and therefore cannot be salvaged.
7. The 100th batch after 99 successful batches can never be adjusted by the quality-control laboratory and therefore must be a total loss.
8. When the plant manager walks into the production department - immediately everything goes wrong.
9. When the plant manager and control supervisor are away, the plant makes the best quality and the most paint.

• • •

A new and special friend is Maureen Lein. Maureen is an expert researcher. She came across some important legal restrictions as quoted from "More Fascinating Facts by David Louis."

In Idaho a citizen is forbidden by law to give another citizen a box of candy that weighs more than 50 pounds.

In New York it is illegal to shoot at a rabbit from a moving trolley car.

In Alaska it is illegal to look at a moose from the window of an airplane or any *other* flying vehicle.

Every citizen of Kentucky is required by law to take a bath once a year. (Do showers count?)

And some names of things you never knew had names—

Aglet—the plastic or metal tip of a shoelace.

Bolster—the part of a knife that separates the blade from the handle.

Bow—the top part of a key.

Kerf—the slit or cut line made by a knife or a saw.

Rictus—the space or gap inside the open beak of a bird.

(I wonder how I made it this far in life without knowing what a Rictus is).

And how Maureen came up with this one I'll never know—

In 1976, a Los Angeles secretary, Jannene Sevift, officially married a 50 lb rock. The ceremony was witnessed by more than 20 people. (I can understand marrying a rock—but a 50 lb. one?)

Each year approximately 250,000 American husbands are physically attacked and beaten by their wives. (Maureen says most probably they deserve it. I say—for shame, Maureen. You sound like a female chauvinist *lady*).

• • •

Some more results from Past President Howard Jerome's vast research and more yet to come—

Most of us will admit to a communications problem in the paint industry. But it's nothing like the communication problem at the San Antonio V. A. Hospital as reported in the November 1981 issue of *CHEMTECH*. Came across this while doing some re-reading.

Quotes from real husbands and wives, mothers and fathers to the San Antonio V.A.—

"Both sides of my parents are poor and I can't expect nothing from them, as my mother has been in bed for one year with the same doctor, and won't change."

"Please send me a letter and tell me if my husband has made application for a wife and baby."

"I am annoyed that you branded me as illiterate. It's a dirty lie as I married his father a week before he was born."

"You changed my little boy to a girl; does it make a difference?"

"In accordance with your instructions, I have given birth to twins in the enclosed envelope."

"My husband had his project cut off two weeks ago and I haven't had any relief since."

—Herb Hillman

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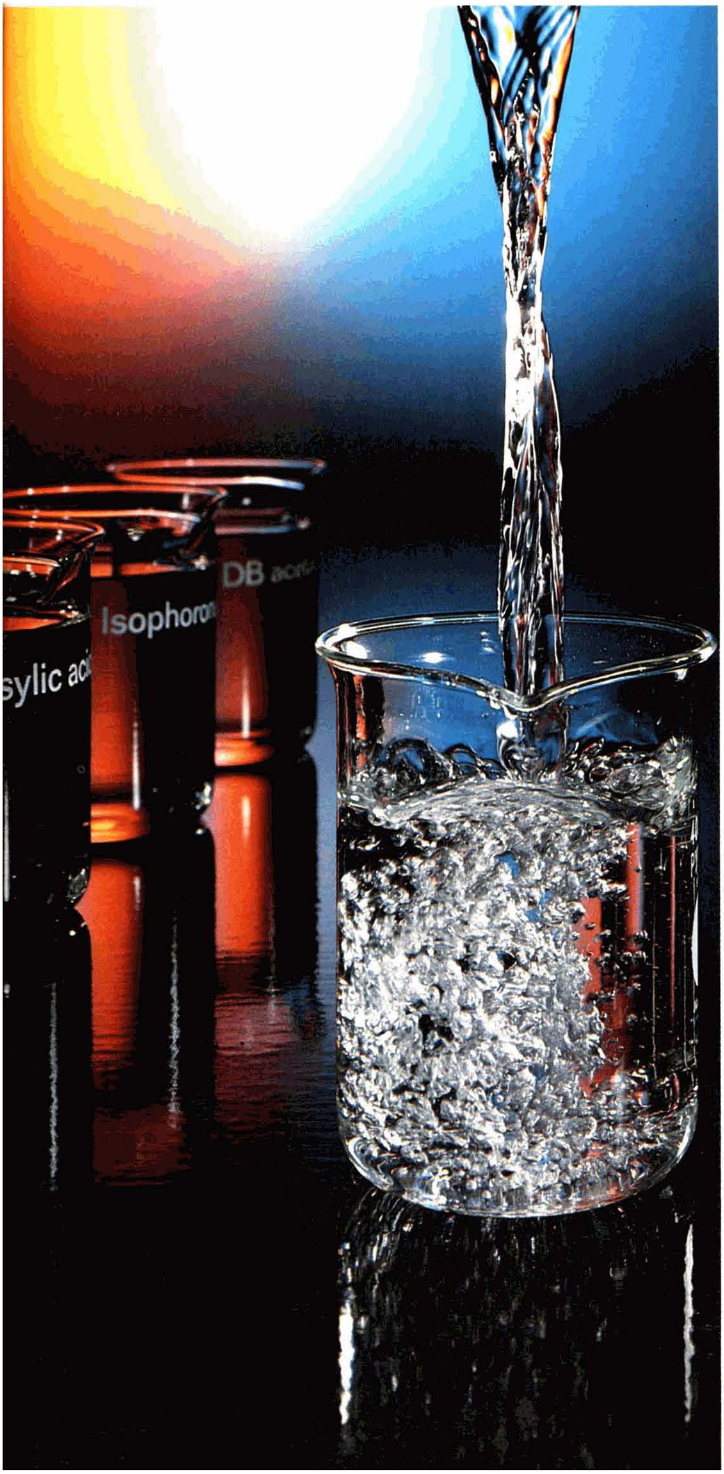

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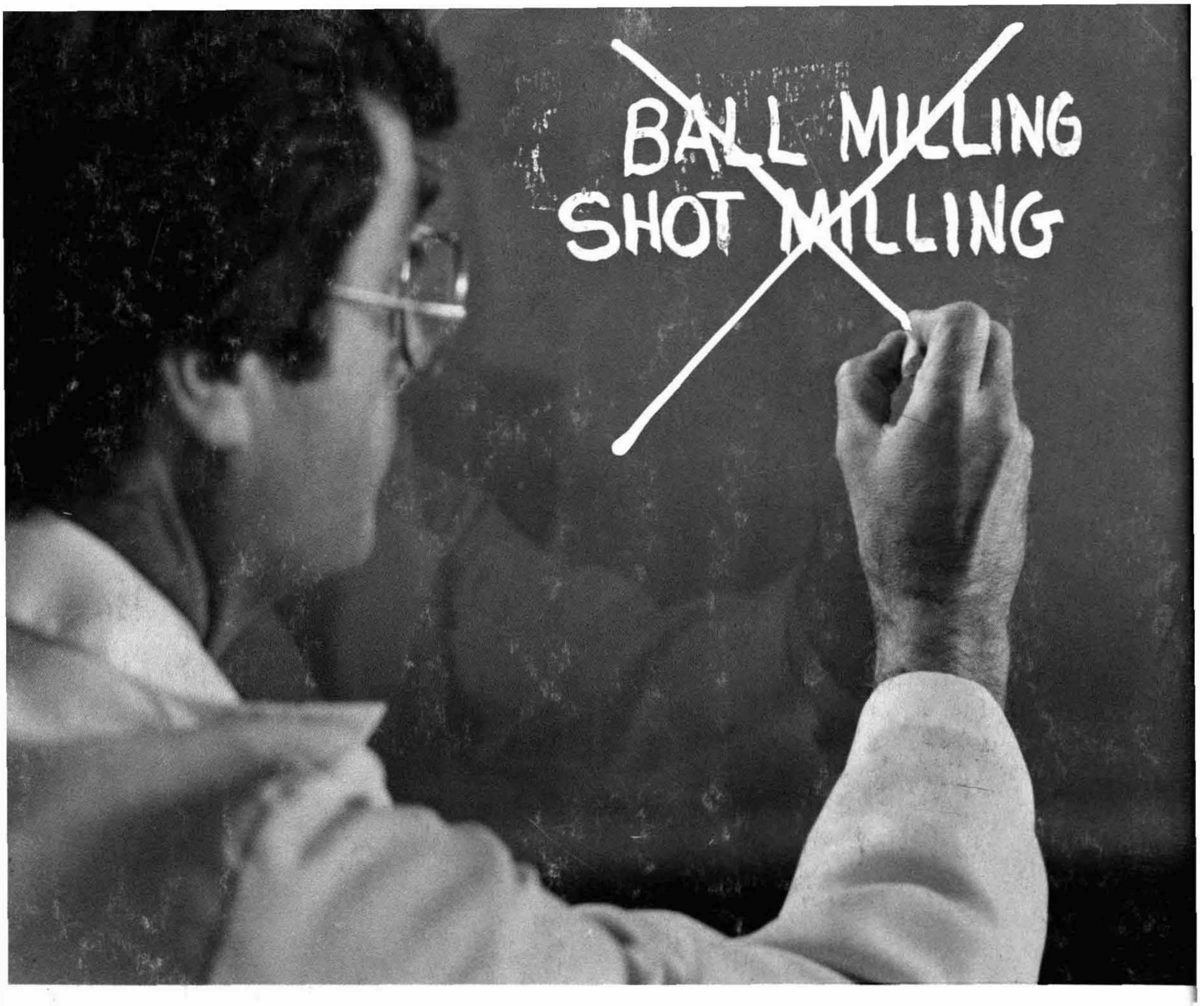
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