

J O C C A

OCCA Conference 1985 – New materials, new problems?

OCCA's Biennial Conference will be held in Edinburgh at the Dragonara Hotel from 2-4 March 1985. The theme is "Substrates, new materials, new problems?"

Below we include some of the summaries of the papers to be presented and the biographies of the speakers in forthcoming issues of the *Journal*.

Summaries of papers and biographies



Keynote address

Dr G. C. Fetts

The coatings industry has been faced with new problems due to the introduction of new substrates and new materials, particularly in the last five years. The changes should be viewed as beneficial because the challenge they present is leading to the development of new technologies and helping revitalise the industry.

The need for new products has brought fresh impetus to research spending which is on the increase. In part this is the reason behind the growth by acquisition of a number of paint companies which are becoming increasingly active in the

Dr G. C. Fetts is Director of Research and Development at Goodlass Coatings Ltd, a major new force into the UK paint industry.

and aerospace industries. The company is primarily a manufacturer of microelectronics, printed circuit, finishing, graphic arts and electrocoat products.

Reader Enquiry Service No. 3

For many years, been producing surface coatings established for more than 100 years and their products are sold throughout Germany, Spain and France.

Also in this issue of decorative paints for industrial coatings.

Hunt Chemical acquires Advanced Paints Inc.

products

An evaluation of the falling rod viscometer and the Inkometer for the testing of news inks

Ban on lead by 1987

by GEOFFREY LEAN
Environment Correspondent

LEAD is to be removed from paint by 1987 as a result of Government pressure.

Junior environment minister William Waldegrave has succeeded in persuading British paint manufacturers to accept the shorter time scale than they had previously said was technically possible. Lead in paint — mainly

Also in this issue

- Dispersion of cuprous oxide in antifouling paints. Coefficients defining shape and size
- Styrenated alkyd resins based on maleopimaric acid

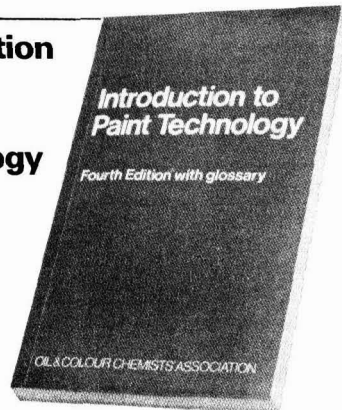
A Fair Deal For Our Advertisers

No guesses, no wishful thinking – the circulation of this journal is audited to the strict professional standards administered by the Audit Bureau of Circulations



The Hallmark of Audited Circulation

Introduction to Paint Technology



The Introduction to Paint Technology, of which over 25,000 copies have been sold, forms an excellent introduction to the whole field of surface coatings and related technologies.

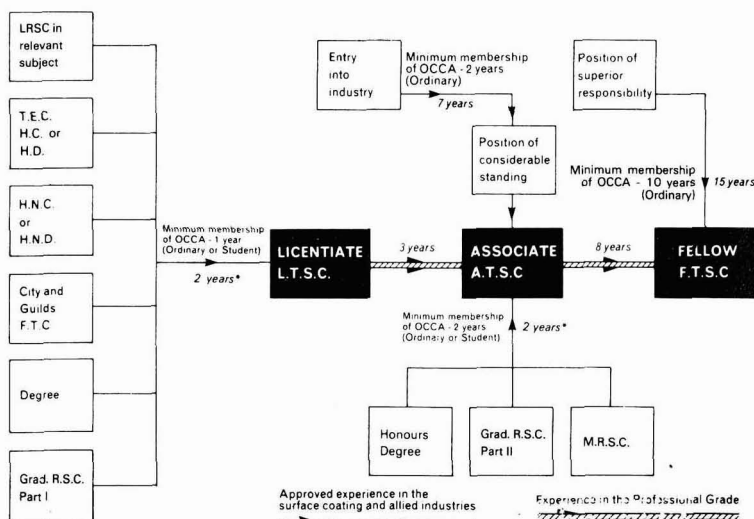
To: OCCA, 967 Harrow Road, Wembley, Middlesex HA0 2SF, UK

Please send copy/ies of Introduction to Paint Technology at £7.50 each (inc. p&p) to the following address (BLOCK CAPITALS):

.....

I enclose remittance (payable to OCCA) for £

Professional Grading in the Technology of Surface Coatings



Ordinary Members of OCCA are invited to apply for the "Optional Professional Grade" at Licentiate (LTSC*), Associate (ATSC*) or Fellowship (FTSC*) level. A schematic representation of the regulations is shown on the left. Successful candidates will be allowed to use the designatory letters shown in brackets above, which will identify their professional status in the industry.

Anyone wishing a complete set of regulations and application form should either write to the Association's Offices or complete the Reader Enquiry Service form (printed at the back of the *Journal*) entering number 304 and stating which grade they are interested in.

*LTSC: Licentiate (of OCCA) in the Technology of Surface Coatings. ATSC: Associate (of OCCA) in the Technology of Surface Coatings. FTSC: Fellow (of OCCA) in the Technology of Surface Coatings.

*Not necessarily after qualification – see regulations.

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



Now there are two; BENTONE SD-2 our second super-dispersible rheological additive is remarkably easy to use in moderate to high polarity solvent systems such as ketones, glycol ethers, esters, alcohol. No need to pregel. No need for high shear. Simply add anywhere in the process, even during letdown. Same outstanding performance as provided by other BENTONE products. An excellent replacement for fumed silica. Our proof is in the bottle. Post the coupon, write or telephone.

STEETLEY MINERALS LTD, P.O. Box 2, Gateford Hill,
Worksop, Nottinghamshire S81 8AF, Tel. (09 09) 47 55 11, Telex 547 901

NL Chemicals Europe Inc., rue de l'Hôpital 31-Bte 6,
B-1000 Brussels, Tel. (02) 512 00 48, Telex 24 662

NL Chemicals

* BENTONE is a trademark of NL Industries, Inc.

Reader Enquiry Service No. 277

STEETLEY MINERALS LTD, P.O. Box 2, Gateford Hill, Worksop, Nottinghamshire S81 8AF
NL Chemicals Europe Inc., rue de l'Hôpital 31-Bte 6, B-1000 Brussels
BENTONE SD-2 rheological additive
Please send sample literature
Address: _____

JULCA 3/89

SURFACE COATINGS

VOL 2—PAINTS AND THEIR APPLICATIONS

Prepared by **OCCA Australia**

Surface Coatings was first published in 1974. Since then the industry has undergone dramatic and rapid changes. For the second edition the book has been split into two volumes, the first covering raw materials and their usage, the second paints and their applications. Volume 1 was published in the autumn of 1983.

Volume 2 gives a comprehensive overview of decorative and industrial paints. Cross references to appropriate chapters in *Volume 1* are provided and the index covers both volumes. Revised and rewritten by over 80 expert contributors from industry, research institutes and universities, the books represent the most up-to-date reference available on paint technology.

Volume 2 is available in December by placing orders now (prepayment only) through the Oil & Colour Chemists' Association at £32.50 (inc. p&p in the UK) plus £3.00 for orders sent overseas by surface mail.

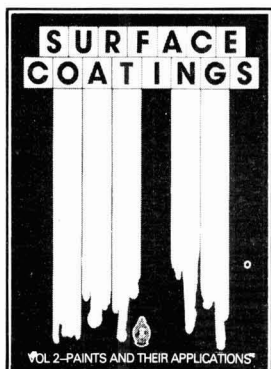
Volume 2 - Hardback - 480 pp.

Contents

Rheology
 Formulating Principles
 Paint Manufacture: Pigment Dispersion
 Paint Manufacture: Processing Operations
 Architectural Coatings
 Heavy-Duty Protective Coatings
 Anti-fouling Paints
 Industrial Coatings
 Automotive Coatings
 Lacquers
 Conversion Coatings
 Powder Coatings

Ultraviolet-Cured Coatings
 Printing Inks
 Components and Technical Aspects of a Paint-Tinting System
 Colour Matching (Using Computerized Techniques)
 Testing and Quality Control
 The Substrate and its Preparation
 Metal Cleaning and Pretreatment
 The Selection of Decorative Paints
 Corrosion and Prevention
 Industrial Coatings: Application and Curing Methods
 Surface Coatings Defects

Analysis of Polymeric Materials
 Technical Service in the Surface Coatings Industry
 Standardisation, Inspection and Accreditation in Australia
 Statutory Requirements of the Paint Industry
 Appendix: Paint Calculations
 Useful Data and Conversion Tables
 Glossary of Terms
 List of Contributors



To: Oil & Colour Chemists' Association
 Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, UK

Please arrange for me to receive copy/ies of "SURFACE COATINGS", Volume 2 Paints and their Applications at £32.50 each (inc. p&p in the UK) plus £3.00 for orders sent overseas, at the following address:
 (BLOCK CAPITALS)

.....

I enclose remittance (payable to OCCA) for £

JOURNAL of the OIL AND COLOUR CHEMISTS' ASSOCIATION

Hon. Editor: D. S. Newton, AMCT
CGIA, FICorrST, FIMF, FTSC

Publications Committee:

D. B. Bannington, ATSC
P. A. Bentley, BSc
L. J. Brooke, ATSC
H. J. Clarke, FTSC
J. Coy, BA
R. E. Cromarty, BSc, ATSC
C. N. Finlay, ATSC
S. R. Finn, BSc, CChem, FRSC, FTSC
B. F. Gilliam, ATSC
J. A. Gant, LRSC
R. G. Handley
A. C. Jolly, BSc, FTSC
A. Macdonald, ANZIC, ATSC
P. Marr, PhD
J. S. Mason, BA
I. Maugham
B. E. Myatt
A. J. Newbould, BSc, CChem, MRSC
R. H. Philbrick
F. B. Redman, FTSC
R. C. Somerville
J. R. Taylor, BSc, CChem, FRSC, FICorrST,
FTSC
J. F. M. Van Campfort, NZCS
G. Warman, FPISA

Editorial correspondence should be
addressed to the Hon. Editor, *JOCCA*,
Oil and Colour Chemists' Association
at the address below.

General correspondence should be
addressed to:

R. H. Hamblin, MA, FCIS,
Director & Secretary,
Oil and Colour Chemists Association
at the address below.

Tel: 01-908 1086
Telex: 922670 (OCCA G)
Telegrams: OCCA Wembley

Assistant Editor: J. C. Setton, BSc

Annual subscription to non-members:
£60.00 (\$120), post free by surface mail,
payable in advance.

Single copies £5.25 (\$12), post free by
surface mail, payable in advance.

© Copyright 1985



Member of the
Audit Bureau of
Circulations

Contents

Vol. 68 No. 3

March 1985

Transactions and Communications

**An evaluation of the falling rod viscometer and the
Inkometer for the testing of news inks** 59
G. Pangalos and J. M. Dealy

**Dispersion of cuprous oxide in antifouling paints.
Coefficients defining particle shape and size** 67
C. A. Giudice and Beatriz del Amo

Styrenated alkyd resins based on maleopimaric acid 71
M. C. Shukla and A. K. Vasishtha

Next month's issue 75

OCCA meetings 75

News 78

BSI news 81

OCCA Conference 1985 82

OCCA news 84

OIL AND COLOUR CHEMISTS' ASSOCIATION
Priory House, 967 Harrow Road, Wembley, Middlesex, HA0 2SF England

The Honorary Editor, the Council and the Oil and Colour Chemists' Association do not accept responsibility for opinions expressed by correspondents or contributors to this Journal. The contents of the Journal are copyright and permission to reproduce Transactions and Communications, in full or in part, must first be obtained from the Honorary Editor



SUPERCHLON

CPO

CHLORINATED RUBBER TYPE

CHLORINATED POLYETHYLENE
CHLORINATED POLYPROPYLENE
CHLORINATED RUBBERS
etc.

APPLICATION

- Anticorrosive coatings
- Road marking paints
- Gravure printing inks
- Adhesives

ADHESIVE GRADES (Low Chlorine Type)

CHLORINATED POLYPROPYLENE
CHLORINATED ETHYLENE VINYL
ACETATE COPOLYMERS
etc.

APPLICATION

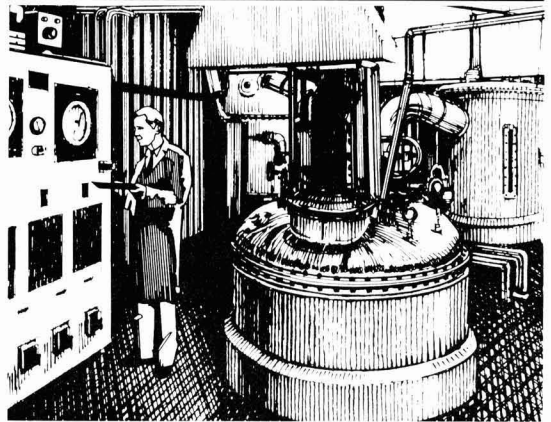
- Gravure printing inks, adhesives for untreated Polypropylenes
- Primer for plastics



SANYO-KOKUSAKU PULP CO., LTD.
CHEMICALS TRADING DEPT.
1-4-5 Marunouchi, Chiyoda-ku, Tokyo, Japan
Telex: J 24279 SK PULP
Cable: SANKOKUPA TOKYO

Reader Enquiry Service No. 283

LET HARDMANS BE YOUR VARNISH MAKER...



There's a world of technical expertise in
HARDMAN'S VARNISHES
— no wonder they are specified by leading
paint and ink manufacturers.

Modern plant, technical knowledge and long
experience ensures close compliance with the
most stringent specification.

Talk to us about varnishes to your own
confidential specification or to our
formulations.

Hardman — the **INDEPENDENT** varnish
specialists.

Don't just ask for varnish —
ask for Hardman's.



HARDMAN'S VARNISHES

Specialist varnish makers to the paint and
printing ink industries.

E. Hardman, Son & Co. Ltd.,
Bedford Street, Hull HU8 8AX, England.
Tel: (0482) 23901 Telex: 527619 ENEMCO G (EHS)

Reader Enquiry Service No. 370

An evaluation of the falling rod viscometer and the Inkometer for the testing of news inks

G. Pangalos and J. M. Dealy

Department of Chemical Engineering, McGill University, 3480 University St., Montreal, Canada H3A 2A7

Summary

A Laray falling cylinder viscometer and an Inkometer have been evaluated as ink test instruments using a series of 19 inks carefully formulated to cover the entire range of composition of North American news inks. These inks were also studied using a research-grade laboratory rheometer, and the results were compared with the data obtained using the two testers.

The ranking of the inks according to high shear viscosity, as determined using the research rheometer, was the same as that based on Laray viscosity at high load, suggesting that the Laray viscometer gives reliable viscosity values. The Inkometer number was found to be a function of time, and the ranking of the inks according to equilibrium value was roughly similar, but not identical, to that based on the high shear viscosity. The Inkometer does not measure any well-defined physical property of an ink.

Introduction

The objective in carrying out ink flow tests is to predict the performance of an ink in the printing press. The correlation of test results with behaviour in the press is not a straightforward matter for several reasons. Firstly, carbon black inks are rheologically complex fluids, and no single type of measurement can provide a complete picture of their flow behaviour. Secondly, there is a lack of a fundamental understanding of the detailed nature of the physical processes that occur when an ink film splits at the exit of the printing nip. As a result, it cannot be said with certainty which physical or chemical properties of the ink and substrates govern the ink's behaviour in this process.

There are two approaches to the question of rating inks on the basis of laboratory measurements. One approach is to make a hypothesis about what fluid properties are important and to make an accurate measurement of these properties. The second approach is to use a test procedure that simulates, in some sense, the printing process. Such a procedure does not yield a well-defined physical property but rather an empirical index of ink quality. In this case, the key questions have to do with the reproducibility of the test and its relevance to ink performance in a press.

This paper presents the results of an extensive evaluation of two commercial ink testers, the falling rod viscometer and the Inkometer. The inks used in the study were also subjected to a rheological characterization using an accurate research-grade rotational rheometer.

Experimental

Formulation of test inks

The principal components of a news ink are: pigment, vehicle, a vehicle property enhancing additive (resin in our studies), and an additive to enhance pigment properties (pitch in our studies). The inks used in the present study were prepared by

mixing these four ingredients in various proportions. The specific components used are listed below.

1. Pigment: Fluffy Elflex 8. A furnace carbon black pigment produced from the middle of a production run to assure a high degree of homogeneity. Manufactured by the Cabot Corporation.
2. Vehicle: Sunthene 4240 oil. This is a refined version of a commercial news ink carrier liquid.
3. Resin: Pico 6140-3. A synthetic hydrocarbon resin made by Hercules.
4. Pitch: Pioneer 26 asphaltum pitch. A dispersant made by Witco Chemicals.

The test inks were prepared in the Montreal plant of Canada Printing Ink using standard ink manufacturing techniques. The ink preparation was performed in two stages. The first stage involved the mixing of two "base" liquids, the "black base" and the "varnish". The black base was a 33.33 per cent (by weight) suspension of carbon black in oil, while the varnish was a 30 per cent resin solution in oil. One kilogram ink samples resulted from combining appropriate proportions of the two base liquids with additional oil and asphaltum pitch, as required. The inks were dispersed thoroughly on a triple roll mill.

The compositions were the same as those used in an extensive rheological study, the results of which have been published previously^{1,2} and these are listed in Table 1. These composi-

Table 1
Compositions of model inks
(Concentrations in weight per cent)

Ink Number	x ₁ Carbon Black	x ₂ Oil	x ₃ Resin	x ₄ Pitch
1	8	92	0	0
2	8	82	10	0
3	8	72	20	0
4	8	80	10	2
5	8	88	0	4
6	8	78	10	4
7	8	68	20	4
8	14	76	10	0
9	14	84	0	2
10	14	74	10	2
11	14	64	20	2
12	14	72	10	4
13	20	80	0	0
14	20	70	10	0
15	20	60	20	0
16	20	68	10	2
17	20	76	0	4
18	20	66	10	4
19	20	56	20	4

tions were selected using established techniques for the design of experiments to cover the entire range of composition of North American news inks, as determined from the listings of the National Association of Printing Ink Manufacturers³.

The densities of the model inks were determined by use of ASTM Standard Test Method D 1475. In addition to the inks, the densities of several resin solutions and the 4240 Sunthene oil were also measured. Through the use of multiple regression, it was found that a linear equation could adequately represent the experimental results.

$$\rho \text{ (Kg/m}^3\text{)} = 934.6 + 4.0615 x_1 + 1.4836 x_3 + 1.2217 x_4$$

Where

x_1 = Carbon black (wt per cent)

x_3 = Resin (wt per cent)

x_4 = Pitch (wt per cent)

The densities of the components were as follows:

Oil: 934.6 Kg/m³ (measured)

Resin: 1083.0 Kg/m³ (measured)

Pitch: 1056.8 Kg/m³ (inferred from ink densities)

Carbon black: 1340.8 Kg/m³ (inferred from ink densities)

Rheological properties of the inks

The basic rheological studies were carried out on a Rheometrics Mechanical Spectrometer (RMS), model 605, equipped with a sensitive torque and normal force transducer (Model T-100). The sample was placed between cone-and-plate fixtures having a diameter of 50 mm and a cone angle of 0.040 radian. The cone apex was ground flat reducing the total cone height by 50.0 μ m. Great care was taken to ensure the precise setting of the gap and alignment of the fixtures. The temperature at which the experiments were conducted was 30 \pm 0.5 $^{\circ}$ C, which is typical of the temperatures at which printing and ink preparation are carried out. Special shock absorbing pads were placed at the base of the RMS in order to minimize the effects of external vibrations on the T-100 transducer signal.

The Mechanical Spectrometer is a sophisticated, general purpose, rotational rheometer capable of generating a wide range of shearing deformations, including steady shear, oscillatory shear and sudden starting and stopping of shear. The inks used in this study were subjected to extensive testing in the RMS, and the results are discussed in detail elsewhere^{1,2}. We present here a summary of the observations made in this study.

When ink flows through a printing nip, it experiences a complex, time-varying deformation pattern in which the shear rate passes through sharp peaks and even changes its sign. The response of an ink to transient shearing deformations is thus of crucial importance in the printing process. The inks were therefore subjected to a variety of shearing patterns including sudden start-up of shear, interrupted shear and reversal of direction of shear. The results showed that the inks, especially those with significant carbon black content, exhibited complex time-dependent behaviour, being thixotropic and viscoelastic.

In order to establish a quantitative ranking of the inks based on rheological behaviour, they were also subjected to steady shearing to determine the steady state shear stress. Curves of shear stress and viscosity for three typical inks, as functions of shear rate, are shown in figures 1 and 2. All of these inks had a resin content of 9.9 per cent.

In qualitative terms, the inks display shear-thinning behaviour while appearing to have a yield stress. The addition of pitch tends to decrease considerably the ink viscosity at low

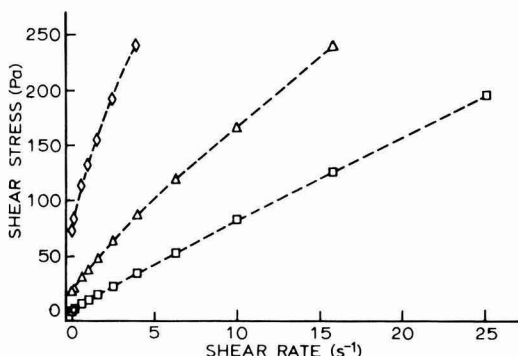


Figure 1. Shear stress versus shear rate: \square Ink no. 6; Δ Ink no. 8; \diamond Ink no. 14

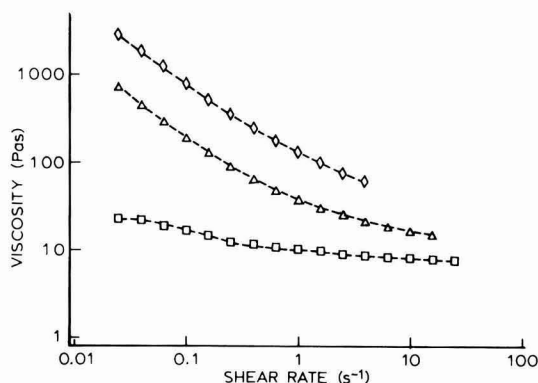


Figure 2. Viscosity as a function of shear rate: \square Ink no. 6; Δ Ink no. 8; \diamond Ink no. 14

shear rates, and the results indicate that there is a definite interaction between pitch and resin. As expected, the viscosity rises with increasing carbon black content. As the shear rate increases, the viscosity appears to approach a limiting value, η_{∞} . This limiting value increases with both resin and carbon black concentration.

The inks were all shear thinning and appeared to have a yield stress. Previous studies of ink rheology^{4,5} have made use of several equations to relate the equilibrium shear stress to the shear rate. These include the Bingham equation and Casson's equation, shown below as equations 1 and 2 respectively.

$$\sigma = \sigma_0 + \eta_p \dot{\gamma} \dots \dots \dots (1)$$

Where

σ_0 = Yield stress

η_p = Plastic viscosity

$\dot{\gamma}$ = Shear rate

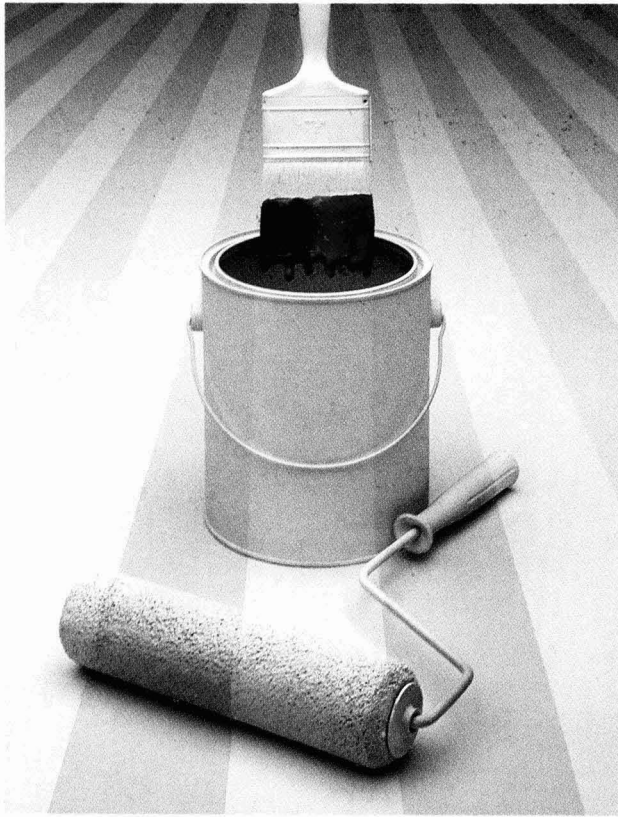
$$\sigma^{\ddagger} = K_c \dot{\gamma}^{\ddagger} = K_0 \dots \dots \dots (2)$$

Where K_c and K_0 are constants for a given material.

While Equation 1 is purely empirical, Equation 2 is based on a physical model for a dilute suspension⁶. However, it has been pointed out^{7,8} that Equation 2 has several serious weaknesses, especially in the case of non-dilute suspensions.

We were able to achieve a better fit of our data by use of Equation 3

$$\sigma = \sigma_B + \eta_{\infty} \dot{\gamma} - \sigma_L \exp(-\lambda \dot{\gamma}) \dots \dots \dots (3)$$



Formulating paint to get just the surface characteristics you want is no easy task. And once you have your formula, variations in the ingredients can't be tolerated.

As the world's largest supplier of diatomite functional fillers to the coating industry, Manville produces a number of Celite grades to give you the exact control you need.

But we don't stop there. With over 50 years' experience in the industry, we know how important consistency is to you. So whether it's for emulsion or solvent coating, the Celite grade you call for is the Celite grade you get. Always consistent.

When you need high quality extenders and flattening agents for uniform gloss and sheen control in your coating formulation, specify Celite. It's consistent bag after bag.

Contact Manville (GB) Ltd.
Ryde House, 391 Richmond Road
Twickenham, Middlesex, TW1 2EQ
Tel: 01 891-0813. Telex: 928635

**Control
gloss and sheen
with Celite® fillers.**

**Consistent—
bag after bag after bag.**



Manville

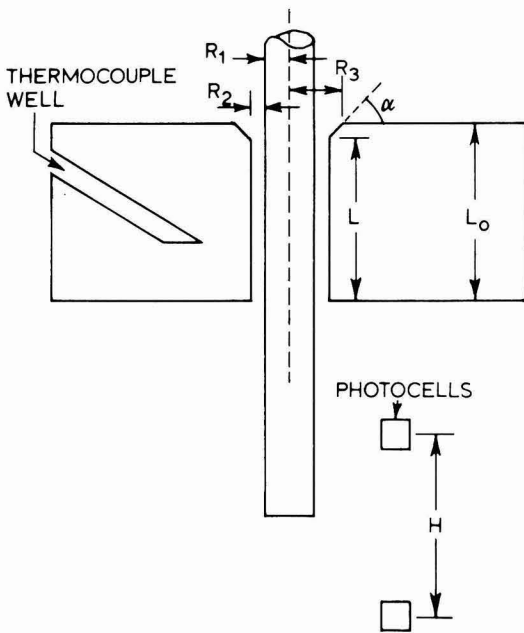


Figure 3. Principal features of the Laray viscometer

The equilibrium shear stress is assumed to be made up of a difference of two contributions. The first follows the classical Bingham fluid behaviour, with a constant slope η_{α} that models the actual ink viscosity at high shear rate, and an intercept σ_B , which is greater than the actual yield stress σ_0 . The difference between σ_B and σ_0 is termed the "stress loss", σ_L . A similar model has been proposed earlier by Shangraw⁹.

The second response results from the exponential decrease of the stress loss σ_L with shear rate. The shear rate above which the exponential decrease no longer contributes to the stress is termed the critical shear rate, $\dot{\gamma}_{crit}$, defined as $5/\lambda$. By substituting:

$$\sigma = \sigma_L + \sigma_0$$

Equation 3 can be rewritten as:

$$\sigma = \sigma_0 + \eta_{\alpha} \dot{\gamma} + \sigma_L [1 - \exp(-\lambda \dot{\gamma})] \dots \dots \dots (4)$$

We have called this the "Bingham Exponential Decrease" (BED) model, since it combines Bingham plastic behaviour with shear rate dependent exponential decrease of the shear stress. Values for the four parameters σ_B , η_{α} , σ_L and λ_1 are listed in Table 2 for seventeen ink formulations.

It is important to note that rotational rheometers are limited to use at rather low shear rates because of the occurrence of flow irregularities at high shear rates. Since the shear rates that an ink experiences in a printing nip are generally much higher than those attainable in a rotational rheometer, it would appear that such a device is of limited usefulness for characterizing inks. However, if confidence could be developed in the general validity of a relationship such as Equation 4 then the results of low shear rate tests could be used to predict the behaviour of the ink at higher shear rates.

Evaluation of the falling rod viscometer

Falling rod viscometers have been used for many years for the industrial testing of fluids, especially for printing inks. Commercial models are available from several manufacturers; the

Table 2
Density measurements

Grouping Number According to Carbon Black Content	Ink Composition (wt %)				Density at 30°C (kg/m ³)
	Carbon Black x ₁	Oil x ₂	Resin x ₃	Pitch x ₄	
1	8	92	0	0	966.7
2	8	82.1	9.9	0	986.6*
4	8	80.1	9.9	2	982.1
5	8	88	0	4	970.8*
					972.7
6	8	78.1	9.9	4	986.7
7	8	67.9	20.1	4	1001.8
8	14	76.1	9.9	0	1004.1
9	14	84	0	2	998.3*
					997.2
10	14	74.1	9.9	2	1002.6*
					1004.9
12	14	72.1	9.9	4	1012.9
16	20	68.1	9.9	2	1031.0*
					1032.6
17	20	76	0	4	1015.8
18	20	66.1	9.9	4	1038.9
19	20	55.9	20.1	4	1053.9
Sunthene 4240	0	100	0	0	935.1†
Varnishes	0	90.1	9.9	0	946.25
	0	85.03	14.97	0	959.35
	0	79.9	20.1	0	962.1

*Replicate experiments

† $\rho_{4240 \text{ oil}} = 942.2 \text{ Kg/m}^3$, 15°C, Table 5.7

one used in this study was a Laray Viscometer, model VM.01, manufactured in France by Adamel Lhomargy. The principal advantages of this type of viscometer are that it is inexpensive and easy to use and that high shear rates can be generated. The disadvantages are that the temperature is not well controlled and the fluid in the shearing gap is not subjected to a uniform time of shearing.

The basic geometry of the Laray viscometer used in this study is shown in Figure 3, while the important dimensions are:

- R_1 = 6.00 mm
- R_2 = 6.03 mm
- R_3 = 9.33 mm
- L = 27.67 mm
- L_0 = 30.97 mm
- H = 10.0 cm
- α = 450

The theoretical equations for calculating the shear rate, shear stress and viscosity for sliding cylinder flow are given in standard reference books on viscometry^{10,11}. The shear stress at the inner wall, σ_1 , is given by Equation 5.

$$\sigma_1 = \frac{F}{2\pi LR_1} \dots \dots \dots (5)$$

Where

- F = Force driving the rod
- L = Length of the shearing zone
- R_1 = Radius of the rod

Clearly, the independent variable in a falling cylinder viscometer is the shear stress rather than the shear rate. For a Newtonian fluid, the shear rate at the surface of the rod is given by Equation 6.

Nothing's better than the CR-100 ... except the new CR-110

Minolta Chroma Meters



MINOLTA

Chroma Meter CR-100
(Chroma Meter II Reflectance)



Chroma Meter CR-100
(Chroma Meter II Reflectance)

Known internationally for its accuracy and reliability, this tristimulus colorimeter measures reflected color and has a measuring area of 8 mm diameter. It has a built-in xenon arc lamp for standard illuminant conditions C and D 65, and features the chromaticity measuring systems Yxy (CIE 1931), and L*a*b* (CIE 1976). It gives instant readings of color deviation in ΔYxy , L*, a* b* and ΔE . Lightweight, compact and cordless.

8 mm

**Hannover-Messe
Halle 12 EG, Stand 103**

**Minolta Camera
Meter Dept.**
Kurt-Fischer-Straße 50
2070 Ahrensburg
West Germany
Telephone (0 41 02) 70-1

Chroma Meter CR-110



Chroma Meter CR-110

A larger measuring area is nearly always required for the measurement of non-uniform and/or structured materials such as plastics, granulates, paper, textiles, etc. The new Chroma Meter CR-110 – which has a measuring area of 50 mm diameter – was specially developed for color measurements with materials of this kind. And it goes without saying that the CR-110 has the same double beam feedback system and other technical features as the CR-100 (Chroma Meter II Reflectance).

50 mm

Reader Enquiry Service No. 312

$$\dot{\gamma} = \frac{V}{R_1 \ln(R_2/R_1)} \dots \dots \dots (6)$$

Thus, the viscosity of a Newtonian fluid is given by Equation 7.

$$\eta = \frac{F \ln(R_2/R_1)}{2\pi L V} \dots \dots \dots (7)$$

In addition to the assumption that the fluid is Newtonian, other assumptions made in deriving equations 6 and 7 are:

1. The rod and the outer cylinder are coaxial.
2. There are no end effects.
3. The velocity is constant during the test.
4. The temperature is uniform in the fluid.

In the case of the falling rod viscometer, the driving force is provided by gravity acting on the rod together with any weight attached to it. Thus, if M is the total mass of the rod and attached weights,

$$F = Mg$$

$$\text{and } \sigma_1 = \frac{Mg}{2\pi L R_1} \dots \dots \dots (8)$$

If the fluid of interest is not Newtonian, equations 5 and 6 are no longer valid. If an equation relating the viscosity to the shear rate is known, then these equations can be revised to permit the determination of the parameters of the equation. If the viscometer is designed in such a way that the relative gap $[(R_2 - R_1)/R_2]$ is quite small, then the shear rate becomes nearly constant across the gap, and the shear rate can be calculated using the approximate expression shown in Equation 9.

$$\dot{\gamma}_1 = V/(R_2 - R_1) \dots \dots \dots (9)$$

For the Laray viscometer used in this study the gap was 3×10^{-5} m, and the variation in shear rate across the gap was estimated to be less than 1 per cent. Under these circumstances, the viscosity can be calculated using Equation 10.

$$\eta = \frac{F(R_2 - R_1)}{2\pi R_1 L V} \dots \dots \dots (10)$$

Or, in terms of the mass, M:

$$\eta \eta = \frac{Mg(R_2 - R_1)}{2\pi R_1 L V} \dots \dots \dots (11)$$

However, if the fluid is thixotropic, i.e. if its viscosity depends not only on the rate of shear but also on the length of time it has been sheared, then there is no straightforward method to obtain well-defined rheological properties using a falling rod viscometer. This is because the total viscous force resisting the fall of the rod is the resultant of shear stresses contributed by fluid elements that have been sheared for various lengths of time. If the approach of the viscosity to its equilibrium value is rapid, as it often is at high shear rates, and if the total time of shearing for a fluid element (proportional to L/V) is relatively long, then the viscosity calculated using Equation 10 may still be a reasonable approximation of the true viscosity at the shear rate given by Equation 9.

To carry out a test using the falling rod viscometer a small quantity of ink ($3-5 \text{ cm}^3$) is applied to the lower end of a metal rod that serves as the inner cylinder. The rod is then dropped through the stationary outer cylinder, coating the shearing surfaces with a thin film of ink. Since the gap is very small the ink film acts as a rod centering mechanism, so that the rod and cylinder can be assumed to be concentric. The rod is subse-

quently pulled back up through the outer cylinder, and excess ink is scraped off the rod into the funnel-shaped entrance of the outer cylinder. A variety of weights can be added to the top of the rod, increasing the shear stress imposed on the ink film. The rod is then released, and the time (t) required for it to fall a fixed distance (H) is measured by means of two photoelectric cells connected to an automatic timer. The velocity is then determined as follows:

$$V = H/t$$

The Laray viscometer located in the Canada Printing Ink manufacturing control centre in Montreal was used for this study. The ambient temperature during the ink viscosity measurements was $27.3 \pm 0.2^\circ\text{C}$. The outer cylinder was in contact with a cylindrical metal jacket through which flowed a steady stream of liquid from a temperature controlled bath (32.3°C). The temperature of the Laray outer cylinder was monitored by means of a thermocouple placed in an oil-filled well drilled in the side of the cylinder. This temperature, which was displayed on a digital readout, ranged between 31.0°C and 32.0°C .

The passage of the rod through the cylinder reduced the gap temperature during the initial and middle span of the fall-time of each ink. This is because of the cooler rod and ink pool at entrance to the gap, since they are affected by the ambient temperature, which was lower than the temperature of the water bath. Precautions were taken prior to each test run to ensure that the annulus temperature had reached its equilibrium ($\approx 31.4^\circ\text{C}$) value.

The rod mass was 130 g, and 25, 50, 100, 150, 200, 300 and 500 g metal weights were added to provide data for a wide range of shear stresses.

Reproducibility was found to be poor at small loads, but this viscometer is not intended for use at low shear stresses. Values of the shear rate and viscosity, calculated using equations 9 and 10, are listed in Table 3 for the largest weight used to study each ink. Also listed are the values of the parameter, η_c , determined from experiments in the Mechanical Spectrometer.

It should be noted that the temperature used for the latter experiments was 30°C , while the nominal temperature for the Laray experiments was 31.5°C . This is a probable explanation for most of the difference between the two values, as temperature is known to have a strong effect on viscosity. Since the variation of viscosity with temperature varies from one fluid to another, we would not expect to observe the same ratio of the two viscosities for all the inks.

To throw further light on this question, the Laray viscometer was also used to study a series of solutions of resin in oil, which should not be thixotropic. The results are shown at the bottom of Table 3. A definite pattern can be seen in which the ratio of the two viscosities is correlated with the carbon black content, decreasing from about 0.5 to 0 per cent carbon black to about 0.27 for 20 per cent carbon black. This seems to reflect a decreased variation of viscosity with temperature as carbon black is added.

Evaluation of the Inkometer

The Inkometer was originally developed by Reed¹² to simulate, on a laboratory scale, the processes occurring as ink flows through a printing roller nip. The essential features of this type of tackmeter are illustrated in Figure 4. Cylinder B is motor driven at a constant speed, while cylinder C rotates and reciprocates along its axis to generate a homogeneous ink film. Stress is transmitted from cylinder B to cylinder A by the ink and results in a net force on cylinder A in the direction "R". The force in the "L" direction required to prevent the displacement of cylinder A is measured and is proportional to the Inkometer Number (IN).

Table 3
Comparison of ink viscosities determined by two methods

Ink no.	η_{∞} (Pas) (Eqn. 4)	η (Pas) (Eqn. 11)	$\dot{\gamma}$ (s ⁻¹) (Eqn. 9)	$\frac{\eta(\text{Laray})}{\eta_{\infty}}$	%C
1	1.826	0.835	1583	0.457	8
5	1.857	2.485	1511	1.338	8
9	3.026	1.160	1749	0.383	14
13	6.673	1.710	1187	0.256	20
17	6.788	1.771	1146	0.261	20
6	7.483	2.993	678	0.400	8
2	7.963	3.054	665	0.384	8
4	8.562	3.481	583	0.407	8
10	9.460	3.579	1749	0.378	14
8	12.287	3.937	755	0.320	14
12	13.874	4.474	665	0.322	14
14	23.732	7.329	277	0.309	20
16	27.070	7.390	275	0.273	20
18	27.257	7.451	405	0.273	20
3	41.875	13.314	152	0.318	8
7	58.351	19.422	104	0.333	8
11	84.253	39.193	76	0.465	14

% Varnish	Varnish-oil Solutions				
0	1.111	0.621	1749	0.5	
9.9	3.511	1.832	1108	0.522	
12.5	5.275	2.626	773	0.498	
15.0	7.744	3.848	528	0.497	
17.5	11.959	5.741	354	0.480	
20.1	19.915	9.222	220	0.463	

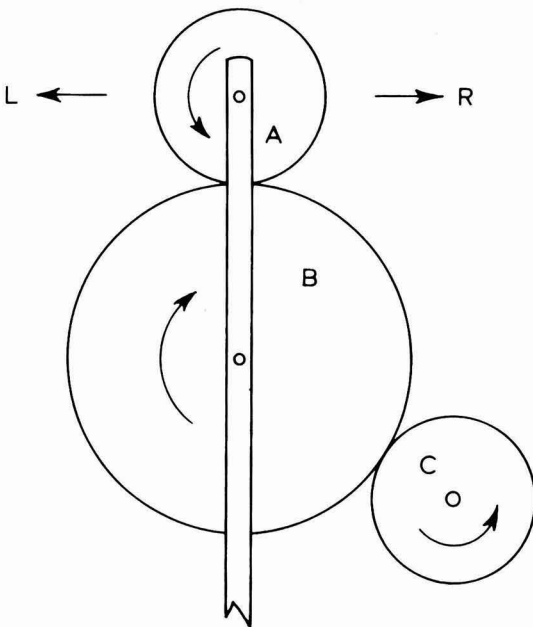


Figure 4. Principal features of the Inkometer

The work of Mewis and Dobbels¹³ has shown that tackmeters of this type do not, in fact, simulate the printing process. The force measured is strongly dependent on the loss tangent of the viscoelastic rubber covering cylinder A, and there is no way to scale-up tackmeter results so that they are quantitatively relevant to press behaviour. Other types of tackmeter have been developed more recently¹⁴ which make a less ambiguous measurement of tack. Nevertheless, these devices continue to be used to compare inks, and it is of interest to know something about the reproducibility of the test

results and their possible correlation with rheological properties.

The Inkometer employed in this study was manufactured by Thwing-Albert (Model No. B-45; Serial No. 29242). The central, metal-covered cylinder could be driven at three rotational speeds, and the results reported here were obtained using the medium speed. A small amount of ink (2-3 cm³) was applied to the Inkometer cylinders while the motor was turned off. The applied ink was then spread over the three cylinders by manually rotating the central cylinder. After three full rotations, the motor was started and the Inkometer Number was determined as a function of time. Replicate runs indicated that the results were quite reproducible.

Figures 5 to 7 are curves of IN versus time for the inks used in this study, while Figure 8 shows similar results for several solutions of varnish in oil. The Inkometer Number varies markedly with time in the early stages of the measurement, usually reaching a steady state value after several minutes.

The transient nature of the Inkometer reading requires that the measurement of the IN always be made at the same time after starting the motor. The initial peak is believed to depend on the mass of ink initially present and on the degree of uniformity in the ink film. The sharp initial decrease in IN is probably due to the loss of fluid as a result of misting. Misting was especially pronounced in the case of the varnish solutions. As can be seen in Figure 8, the transient curves for these materials are more complex in shape. It is possible that the second maximum is a viscoelastic effect. The presence of carbon black appears to suppress this aspect of the response.

No simple correlation could be found between ink composition and IN. In Table 4 the inks are listed in order of increasing IN, and the value of η_{∞} is also shown. The ranking according to η_{∞} is similar but not identical. Thus, while IN does not have a simple correlation with η_{∞} , high shear rate viscosity clearly plays an important role in ink flow in an Inkometer.

Conclusions

The rheological measurements performed on a Rheometrics

Table 4
Ranking of Inks according to Inkometer Number

Ink Number	Equilibrium Inkometer Number	η_{sp} (Pas) (Eqn. 4)
1	2.4	1.826
5	2.5	1.857
9	3.0	3.026
13	3.5	6.673
17	4.0	6.788
2	5.0	7.963
8	6.1	12.287
10	6.3	9.810
6	8.0	7.483
14	9.0	23.732
4	9.2	8.562
12	10.0	13.874
16	10.5	27.070
18	11.0	27.757
3	21.7	41.875
7	25.6	58.351
11	28.7	84.253
15	34.8	
19	40.5	

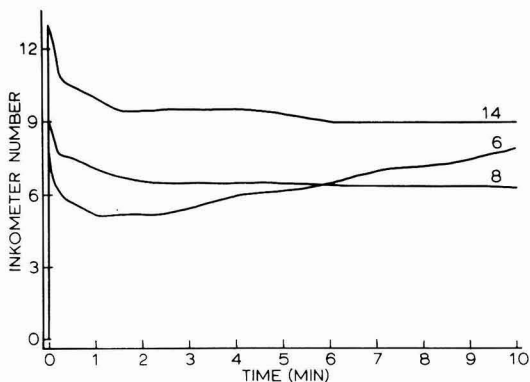


Figure 5. Inkometer number versus time for inks 6, 8 and 14. All three had a resin content of 9.9 wt per cent

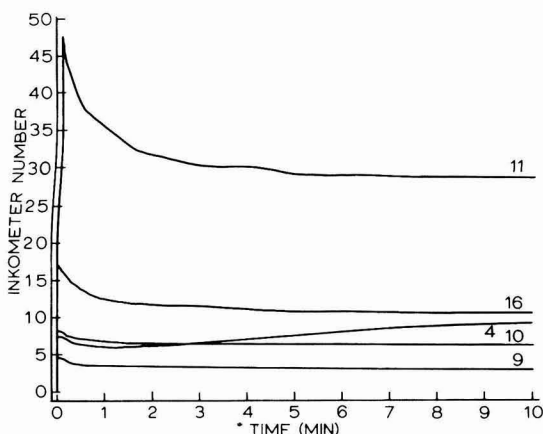


Figure 6. Inkometer number versus time for inks 4, 9, 10, 11 and 16

Mechanical Spectrometer revealed that the inks display shear-thinning behaviour, thixotropy, yield stress, and a shear stress response that is dependent on the nature and duration of previous shear. The addition of carbon black increases the

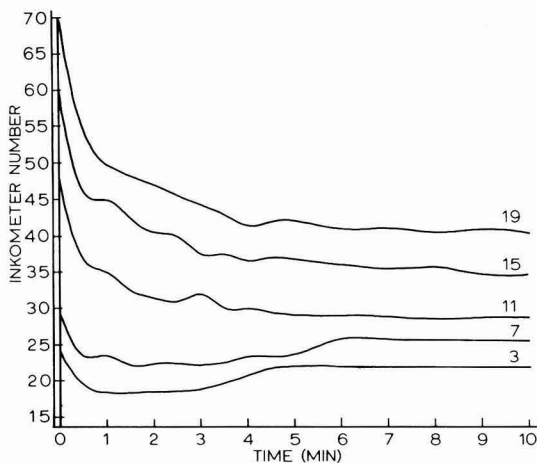


Figure 7. Inkometer number versus time for inks: 3, 7, 11, 15 and 19. All had a resin content of 20.1 wt per cent

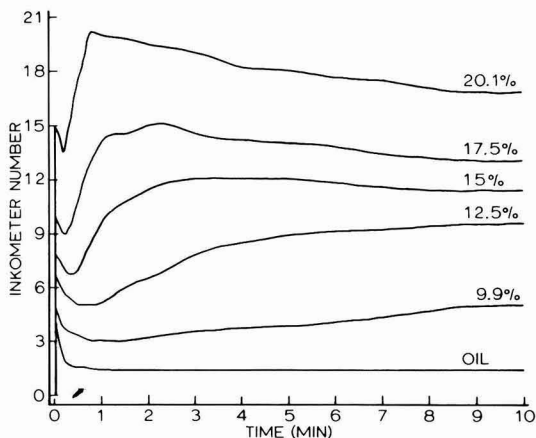


Figure 8. Inkometer number versus time for resin - Oil Solutions (varnishes) with resin concentrations up to 20.1 wt per cent

equilibrium viscosity and the yield stress of an ink, while the addition of pitch reduces the low shear viscosity.

The Laray viscometer was found to yield a reasonably precise value of the steady shear equilibrium viscosity of the inks at high shear stresses. The Inkometer, while neither measuring any well-defined physical property nor simulating in any quantitative sense the printing process, does provide an interesting characterization of the inks. The fact that the ranking according to equilibrium Inkometer Number varies from the ranking according to high shear viscosity emphasizes that the flow in the nip cannot be analyzed solely through the use of steady shear results. Thus, although the Laray gives a good steady shear rheological characterization of the inks, this is not directly relevant to nip flow.

Acknowledgements

The authors are most grateful to the Pulp and Paper Institute of Canada for their financial and technical support, and to Canada Printing Ink for preparing the inks used in this study and allowing the use of their Laray viscometer and Inkometer.

[Received 1 August 1984]

References

1. Pangalos, G., Dealy, J. M. and Lyne, M. B., *J. Rheol.*, 1985, in press.
2. Pangalos, G., "The rheological properties of letterpress and lithographic inks", M.Eng. dissertation, Chem.Eng., McGill Univ., July 1983.
3. National Association of Printing Ink Manufacturers, *Printing Ink Handbook*, 3rd Edit., *Harrison, NY*, 1976.
4. Rosted, C. O., *JOCCA*, 1971, **54**, 520.
5. Kellerstrom, J., *JOCCA*, 1973, **56**, 95.
6. Casson, N., "Rheology of Disperse Systems", ed. by Mill, C. C., *Pergamon Press, London*, 1959, 84.
7. Weymann, A. D., *Proc. 4th Intern. Cong. Rheol., Interscience, NY*, 1965, **3**, 573.
8. Sherman, P., *Industrial Rheology, Academic Press, NY*, 1970.
9. Shangraw, R. E., Grim, W. and Mattocks, A. M., *Trans. Soc. Rheol.*, 1961, **5**, 247.
10. Van Wazer, J. R., Lyons, J. W., Kim, K. Y. and Colwell, R. E., "Viscosity and Flow Measurement", *Interscience, NY*, 1963.
11. Dealy, J. M., "Rheometers for Molten Plastics", *Van Nostrand Reinhold Co.*, 1982.
12. Reed, R., *Amer. Ink Maker*, 1938, **16**, 37.
13. Mewis, J. and Dobbels, F., *Ind. Eng. Chem. Prod. Res. Dev.*, 1981, **20**, 515.
14. Kelhä, V., Manninen, M. and Ottingen, P., *JOCCA*, 1974, **57**, 184.

Dispersion of cuprous oxide in antifouling paints. Coefficients defining particle shape and size

C. A. Giúdice and Beatriz del Amo

CIDEPIINT – Research and Development Centre for Paint Technology (CIC – CONICET), 52 entre 121 y 122, 1900 La Plata, Argentina

Introduction

The main objective of pigment dispersion in the paint manufacture process is separating clustered particles and keeping them permanently isolated from each other.

As a general rule, particles are associated in the form of clusters due to their high surface force (high free energy per mass unit). These aggregates may appear after the evaporation of the washing liquids due to the incipient sintering, when high temperature methods are used in obtaining the pigment, or as a result of compacting forces applied during the storage of the packed pigment. However, the size of the primary or individual particles is generally sufficiently small and thus appropriate for its utilization in industrial processes.

During pigment dispersion in the vehicle there is an initial air displacement due to a flow of the vehicle in the interstices of the pigment mass. This wetting process depends on the viscosity of the vehicle and on the compaction degree of the agglomerates. Even under favourable conditions (low vehicle viscosity and high solid porosity) the dispersion process requires mechanical energy so as to wet the particles and, additionally, to produce stable separation. The latter is attained when each one of the particles remains surrounded with a sufficient amount of the vehicle, thus avoiding contact with the other particles.

If dispersion stability is not appropriate, particles join again and form flocules. The flocules are associations that may include from a few to hundreds of primary particles^{1,2}.

The shape and the size of the particles show a significant influence upon the various paint characteristics, such as: hiding power, rheological behaviour, film aspect and gloss retention, durability and resistance to chalking, checking and cracking.

The objective of this paper is to determine coefficients that may serve to define the shape and the size of discrete or individual particles and of associations of the latter.

Method

In order to perform these experiments, four commercial

samples of cuprous oxide were selected. This is a pigment that is commonly used as toxicant in antifouling paints. Figure 1 shows characteristics of the particles in this pigment as viewed through an electronic microscope (enlarged 1,000 and 5,000 \times).

The selection of cuprous oxide for these experiments was made based upon the fact that its particle size distribution plays an important role in the biocide power of antifouling paints.

Specific area of the discrete particle

Both the shape and the size of the particles and dispersion efficiency refer to the external area of the solid body. Since calculating the number of particles included in a mixture is unpractical, the basis for evaluating the surface is by considering the mass unit. In this way the idea of specific area is established. This value, multiplied by the sample mass, defines the interfacial area. The specific area is an important property of solid bodies and varies significantly with the characteristics of the interfacial area and the size of the particles.

The specific area can only be calculated if the geometrical shape of the particles is known. In the case of spheres, the superficial area is Πd^2 , where d is the diameter, the mass being $\rho \Pi d^3/6$, where ρ is the density. Consequently the specific area of a spheric particle becomes $6/\rho d$.

However the geometrical shape is usually different and, therefore, the specific area cannot be calculated by means of the above expression. For this reason, the specific area of the discrete or individual particles has been determined by means of an Accusorb Micromeritics Absorption Unit, based on the BET theory³. This was performed after degassing the samples by high vacuum during two hours and at 150°C.

Specific area of particle associations (aggregates)

In the case of associated particles, the superficial area was determined on the basis of the specific dissolution rate of cuprous oxide in an 0.48 M sodium chloride solution, with pH 8.2 and at 20°C temperature. Starting from experimental dissolution time and dissolved mass of cuprous oxide, the

DISPERSE-ONE

A MOST EFFICIENT AND ECONOMIC PIGMENT DISPERSANT

**FROM A PAINT MANUFACTURER WHO USES IT
IN HIS FORMULATIONS**

BUY OR PRODUCE YOURSELF

**Write to: Amos Hardof
Vice President R & D
Tambour Ltd
Paint & Chemical Industries
PO Box 2238, Akko 24101
Israel**

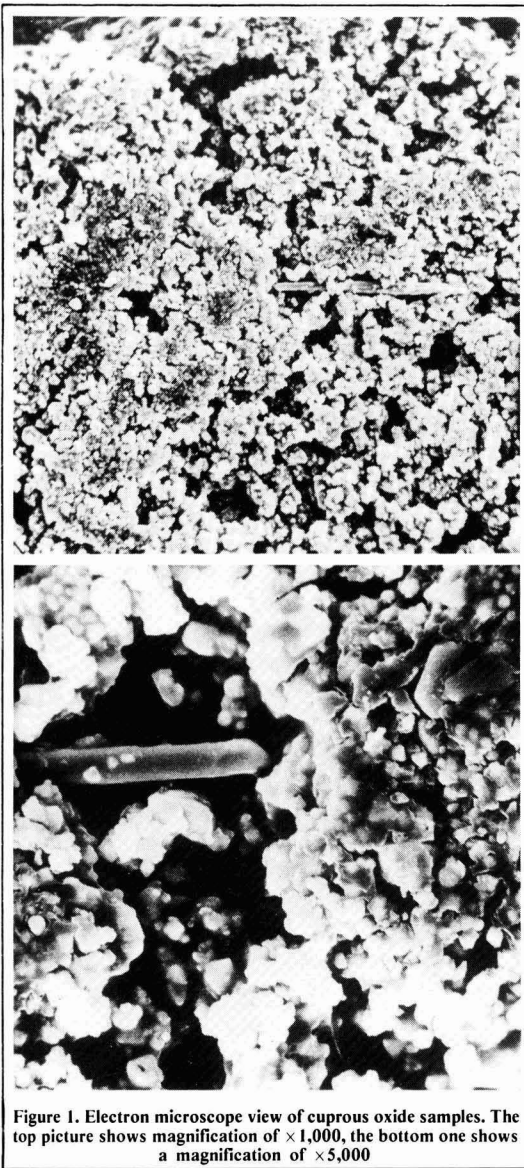


Figure 1. Electron microscope view of cuprous oxide samples. The top picture shows magnification of $\times 1,000$, the bottom one shows a magnification of $\times 5,000$

evaluation was performed with wholly deflocculated particles (this was verified microscopically).

The mean specific area of associated particles was assessed by relating the previously determined area with the dispersed cuprous oxide mass.

Five dispersion times were selected so as to obtain different mean particle size. The maximum cuprous oxide concentration in the solution⁴ was 0.5 ppm. This was established colorimetrically⁵.

Mean diameter of associated particles (aggregates)

The diameter of discrete particles (d), and that of the aggregates (D), was assessed microscopically. The correspond-

ing mean diameters \bar{d} and \bar{D} were calculated using the following formula:

$$\frac{\sum f (\text{diameter})^2}{\sum f}$$

where f is the frequency at which each particle or particles association is present in the dispersion. The word diameter refers to the values of d or D .

Shape and size correction factors

The following experimental relations are defined:

1. *Shape factor of individual or discrete particles* (f_1). It relates the real specific area of the discrete particles obtained through BET with that corresponding to the discrete particles calculated as spherical, starting from diameter d , by means of the expression $6/\rho d$.
2. *Shape factor of the aggregates* (f_2). It relates the surface area of particles associations with that calculated as spherical, starting from diameter D , by means of the expression $6/\rho D$.
3. *Size factor of the aggregates* (f_3). It relates the real specific area of the discrete particles obtained through BET with that of the associated particles.
4. *Size and shape factor of the aggregates* (f_4). It relates the real specific area of the discrete particles obtained through BET, with that of the particles associations calculated as spherical, starting from diameter \bar{D} , by means of the expression $6/\rho \bar{D}$.

Table 1
Composition of cuprous oxide samples, g/100 g

Sample	Cuprous copper*	Cupric copper†	Metallic copper
1	99.81	0.04	0.03
2	99.22	0.51	0.11
3	98.17	1.33	0.23
4	97.71	1.57	0.31

*Shown as cuprous oxide (Cu_2O)

†Shown as cupric oxide (CuO)

Table 2
Characteristics of the tested samples

Sample	Diameter \bar{d} μm	Specific area $\text{cm}^2 \text{g}^{-1}$	Dissolution rate $\mu\text{g cm}^{-2} \text{day}^{-1}$
1	0.4	30 800	255
2	0.7	18 200	248
3	1.1	12 070	246
4	1.3	10 699	239

Results and conclusions

The samples of cuprous oxide selected for the experiment, after eliminating the stabilizer by washing, show the composition indicated in Table 1.

Table 2 shows the diameters and specific areas of the discrete particles for each one of the samples, as well as the specific dissolution rate in the aqueous solution mentioned above.

These experimental results allowed the calculation of factor

f_1 (shape of the discrete particles) for each one of the pigment samples selected. Figure 2 shows the values of this factor as a function of the mean diameter of the particles. Direct proportionality may be observed for both values of the specific area. Since the value $f_1 = 1$ indicates spherical particles, this factor shows in how much discrete particles differ from sphericity. Thus, a mathematical quantization has been obtained for the shape of the individual particles.

Table 3 shows the specific area of the associated particles, whose determination involved the evaluation of the specific dissolution rate by means of the above mentioned methodology as a function of mean diameter \bar{D} .

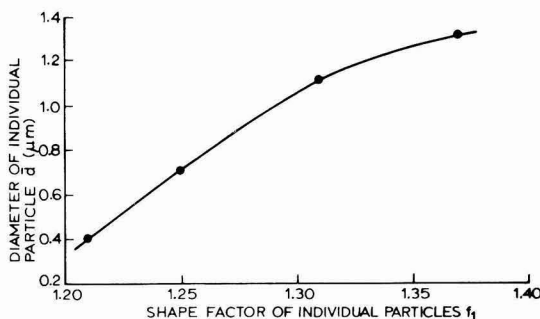


Figure 2. Separation from sphericity of discrete particles as a function of their mean diameter

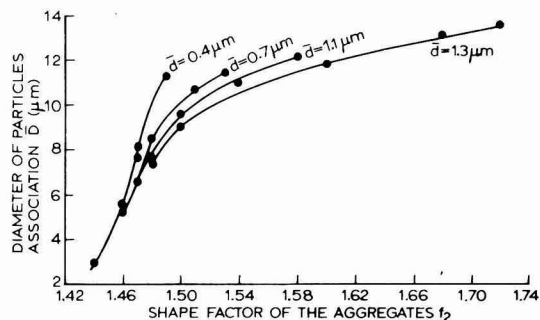


Figure 3. Separation from sphericity of particles associations as a function of their mean diameters

Factor f_2 (shape of the aggregates) is shown to be, as with f_1 , directly proportional to the mean diameter of the associated particles \bar{D} (Figure 3).

Figure 3 also shows that, for an equal mean aggregate diameter (\bar{D}), discrete particles with a greater mean diameter (\bar{d}) lead to particles associations that farther differ from sphericity (larger shape factor f_2). This means that these associations have a larger real specific area.

Factor f_2 proved to be relevant, since for a given cuprous oxide dispersion, it allows the calculation of the real specific area of the aggregates.

With regard to factor f_3 (size of the aggregates), it must be noted that it is related to dispersion efficiency (Figure 4). For a given size of discrete particles, a larger factor f_3 indicates a larger mean diameter (a higher number of discrete particles and a larger specific area of associated particles) and, therefore, lower dispersion efficiency.

Table 3
Specific area of associated particles (aggregates)

Discrete particle \bar{d} , μm	Associated particles \bar{D} , μm	A , $\text{cm}^2 \text{g}^{-1}$
0.4	2.9	5 050
0.4	5.4	2 750
0.4	7.6	1 967
0.4	8.1	1 846
0.4	11.3	1 341
0.7	3.6	4 103
0.7	5.2	2 860
0.7	8.5	1 774
0.7	10.6	1 451
0.7	11.2	1 392
1.1	6.4	2 328
1.1	7.6	1 974
1.1	9.6	1 584
1.1	10.9	1 432
1.1	12.2	1 312
1.3	7.3	2 058
1.3	9.1	1 673
1.3	11.7	1 388
1.3	13.0	1 312
1.3	13.5	1 293

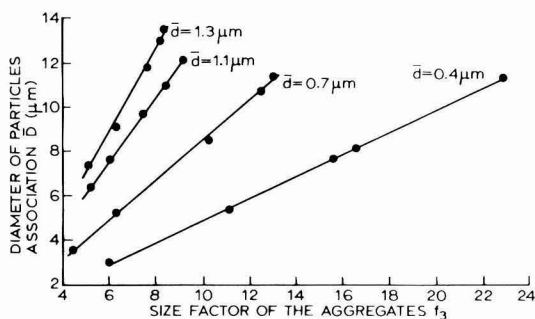


Figure 4. Relative index of the number of discrete particles involved in the aggregates, as a function of their mean diameters

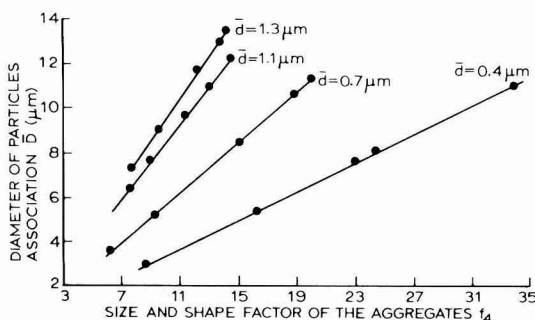


Figure 5. Relation between the specific area of discrete particles and that of particles associations, as a function of the mean diameters

All this led to the conclusion that factor f_3 is a relative index of the number of particles involved in the association.

The definition of the factor f_4 (shape and size of the aggregates), and the experimental values obtained for factors f_2

and f_3 , lead one to conclude that f_4 is equal to the product of f_2 by f_3 , and since f_3 is higher than f_2 , the behaviour of f_4 follows that of f_3 .

The significance of factor f_4 is given by the fact that the specific area of the discrete particles obtained by dispersion of cuprous oxide may be calculated by multiplying the specific area of the associated particles, as from \bar{D} , by factor f_4 taken from Figure 5 for the corresponding \bar{d} value.

Acknowledgements

The authors are grateful to CINDECA (Research Centre on Catalytic Processes) for its contribution in the assessment of the specific area of the particles with the Accusorb Micromeritics Absorption Unit, and also to the Comisión de Investigaciones Científicas de la Provincia de Buenos Aires

(CIC) and Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) for the sponsorship of CIDEPIINT's research programme.

References

1. Patton, T. C., "Paint flow and pigment dispersion". *John Wiley & Sons, New York, USA*, 1978.
2. Giudice, C. A., Benitez, J. C. and Rascio, V., *JOCCA*, 1984, **67**, 283.
3. Dollimore, D., Spooner, P., *J. Appl. Chem. Biotechnol.*, 1974, **24**, 35.
4. Ketchum, B. H., Ferry, J. D., Redfield, A. C. and Burns, A. E., *Ind. Eng. Chemistry*, 1945, **37**(5), 456.
5. Snell, F. D., Snell, C., "Colorimetric methods of analysis". *D. van Nostrand Co. Inc., New York, USA*, 3rd ed., vol. 1, 1936.

Styrenated alkyd resins based on maleopimaric acid

M. C. Shukla and A. K. Vasishtha

Harcourt Butler Technological Institute Kanpur-208002 (India)

Abstract

Unstyrenated alkyd resins were prepared from maleopimaric acid and phthalic anhydride separately using monomeric dehydrated castor oil. These alkyds were styrenated using the post-styrenation process by addition of tung oil and using benzoyl peroxide as an initiator. The styrenated alkyd films showed an improvement in film properties: such as drying time, scratch hardness, rocker hardness, resistance towards water, and acid and alkali; over the unstyrenated alkyd films. Both the styrenated alkyd films, based on maleopimaric acid and phthalic anhydride, behaved in exactly the same way for all the film properties except hardness. Baked films showed an improvement in all the film properties over air-dried films.

Introduction

Styrenated alkyds may be considered to be resin modified alkyds; the resin being polystyrene. Polystyrene is tougher and more durable than the natural resin-modifiers generally used, and the styrenated alkyds show similar advantages of better toughness and durability. Polystyrene has good resistance to water and alkalies and this quality is imparted to the styrenated alkyd. The styrenated alkyds have established a definite position in the field of fast air-drying and baking finishes.

There is hardly any information available on copolymerisation of non-phthalic alkyds with styrene. However, some information is available on copolymerisation of oils and conventional phthalic alkyds with styrene. Non-phthalic alkyds are essentially oxidising resins in which phthalic anhydride has been replaced by fatty acid-maleic adduct, rosin-maleic adduct, and maleopimaric acid, trimellitic acid, succinic acid, etc. The copolymerisation of oils with styrene has been extensively studied by several workers^{1,8}. Bhow and Payne⁹ studied styrenated DCO-phthalic alkyd resin prepared by first styrenating the DCO fatty acids and then allowing them to react with phthalic anhydride and glycerol. Evaluation of these styrenated alkyds showed that they had superior drying times and chemical resistance to the conventional phthalic alkyds. According to Heavers¹⁰ the styrenation of phthalic alkyds

results in improved hardness and resistance to acids and alkalies. Bevan *et al*¹¹ correlated the film properties of vinyl hydrocarbon modified phthalic alkyd resins based on linseed-tung oil and tobacco oil-DCO and reported that the later crosslinked more readily than the former in spite of lower total unsaturation and lower degree of conjugation. Gupta *et al*¹² prepared styrenated phthalic alkyds based on babul oil (*Acacia arabica*) by pre-styrenation and post-styrenation processes and their film properties were compared with those of unstyrenated tobacco seed oil alkyds. The alkyds prepared by the post-styrenation process gave better film properties than the alkyds prepared by the pre-styrenation process. Shukla *et al*¹³ prepared styrenated tobacco oil phthalic alkyd by pre-styrenation and post-styrenation processes and studied the film properties of their air-dried as well as baked films along with those of unstyrenated tobacco oil alkyds.

In the present work, non-phthalic alkyd resin has been prepared from maleopimaric acid. The styrenation of the non-phthalic alkyd and the conventional phthalic alkyd has been achieved by a post styrenation process. The properties and performance characteristics of these alkyds have been compared with each other.

Experimental

Materials

Dehydrated castor oil (DCO): Commercial acid value 5.1, iodine value 136.0, hydroxyl value 18.0, viscosity (25°C) 2.0 poises, and colour 16.8Y + 2.1R.

Tung oil: Acid value 3.6, viscosity (at 25°C) 4.0 poises, iodine value 161.0, and colour 20.4Y + 7.6R.

Glycerol: Sarabhai Merck, LR grade.

Ethylene glycol: Sarabhai Merck, LR grade.

Phthalic anhydride: LR grade.

Maleopimaric acid (Prepared in laboratory): Acid value 420.0, melting point 228.5°C, optical rotation $[\alpha]_{D}^{25} -32.1$.

Table 1

Styrenation of alkyds in xylene at 140°C for 20 hours with benzoyl peroxide initiator

S. No.	Initiator (% by wt of alkyd)	Clarity	
		Styrenated maleopimaric non-phthalic alkyd	Styrenated phthalic alkyd
1.	1.0	Hazy	Hazy
2.	1.5	Hazy	Hazy
3.	2.0	Hazy	Hazy
4.	2.5	Slightly hazy	Hazy
5.	3.0	Clear	Slightly hazy
6.	3.5	—	Clear

Styrene monomer: LR grade, refractive index (at 30°C) 2.5423, specific gravity 0.9108, boiling range 140-145°C.

Benzoyl peroxide: LR grade.

Xylene: LR grade, sulphur free, boiling range 137-142°C.

Red oxide of Iron: Commercial, synthetic, Fe₂O₃ content 93.6 per cent.

Zinc chrome: Commercial Cr₂O₃ content 45.6 per cent.

Cobalt naphthenate: Metal content 4.5 per cent.

Preparation of alkyds from maleopimaric acid

DCO and glycerol were reacted in a three-necked flask fitted with stirrer, condenser and thermometer. Inert gas (N₂) was passed into the reaction mixture through a glass tube. The mixture was heated to 200°C and 0.1 per cent catalyst (lime and litharge in a ratio of 1:1) of the weight of the oil was added. The temperature was raised to 240°C and maintained there for one hour after which the temperature was lowered to 200°C. At first, ethylene glycol and thereafter maleopimaric acid were added slowly to the reaction mixture. The temperature was raised to 250°C gradually and maintained until the desired acid value and viscosity were obtained. The formulation of the alkyd based on maleopimaric acid was as follows:

Ingredients	Parts by weight
DCO	600
Maleopimaric acid	240
Glycerol	50
Ethylene glycol	25

Preparation of alkyds from phthalic anhydride

DCO and glycerol were heated to 200°C in a three-necked flask fitted with a stirrer, a gas inlet tube and a thermometer. Catalyst (lime and litharge in the ratio of 1:1), 0.1 per cent of the oil weight, was added to the reaction mixture and the temperature was raised to 240°C slowly. The temperature was kept constant until monoglyceride tolerance in methanol (1:3) was obtained, after which DCO fatty acid and phthalic anhydride were added slowly to the reaction mixture at 180°C. The temperature was further raised to 240°C and maintained there until the desired acid value and viscosity were reached. The formulation of the phthalic alkyd was as follows:

Ingredients	Parts by weight
DCO	340
DCO fatty acids	232
Phthalic anhydride	200
Glycerol	108

Preparation of styrenated alkyd from maleopimaric acid

In a typical experiment the alkyd, tung oil and xylene were placed in a three-necked flask with thermometer, condenser and stopper. The requisite amount of initiator was added in the reaction mixture and the temperature raised to 140°C (refluxing temperature). At this stage, half the amount of styrene monomer was added to the flask. The remaining quantity of styrene was added after two hours refluxing and the refluxing continued for 20 hours. After this period xylene was removed by vacuum distillation until a product having 50 per cent solids was obtained. Different concentrations of initiator were tried. The results are shown in Table 1. The final product was prepared according to the following formulation:

Ingredients	Parts by weight
Alkyd based on maleopimaric acid	300
Tung oil	30
Styrene	300
Xylene	900
Benzoyl peroxide	9

Preparation of styrenated alkyds from phthalic anhydride

The procedure adopted for preparing styrenated phthalic anhydride based alkyds was the same as that described above for preparing styrenated alkyd from maleopimaric acid. In this process too, different percentages of initiator were tried. Except for the amount of initiator used in this case which was 3.5 per cent on the weight of alkyd taken for styrenation, the proportions of the other ingredients were the same. The results are shown in Table 1.

Preparation of paints from styrenated alkyds

For this purpose, red oxide zinc chromate primers were prepared from both the styrenated alkyds separately as follows by the usual procedure. The composition of the primer paint was as follows:

Ingredients	Parts by weight
Red oxide of iron	42.00
Zinc chrome	8.00
Styrenated alkyd (50% solution in xylene)	50.00
Cobalt naphthenate (4.5% Co)	0.17

Characterisation and evaluation of film performance of styrenated alkyds

The physico-chemical characteristics of both the styrenated alkyds such as clarity, acid value, viscosity, and colour, were determined and the results are given in Table 2.

The film properties of both air dried and baked films of styrenated alkyds were determined and the results are given in Table 3. The film characteristics of the primers are given in Table 4.

Results and discussion

The different experiments of styrenation of non-phthalic alkyd based on maleopimaric acid were carried out by varying the amount of initiator and solvent, separately. The process adopted for styrenation of this alkyd was post-styrenation. In all the experiments, hazy products were obtained. This may be due to the fact that the maleopimaric acid molecule is bulky in nature which causes some steric-hinderances on the double

Table 2
Characteristics of unstyrenated and styrenated alkyds

Sl. No.	Product	Acid value	Viscosity of 50% solution in xylene at 25°C (Poise)	Colour of 50% solution in xylene (Lovibond unit)
1.	Unstyrenated alkyds			
	(i) Maleopimaric non-phthalic alkyd	16.1	0.5	22.0Y + 5.5R
	(ii) Conventional phthalic alkyd	16.6	0.5	25.4Y + 6.3R
2.	Styrenated alkyds			
	(i) Maleopimaric non-phthalic alkyd	19.3	1.0	25.8Y + 6.2R
	(ii) Conventional phthalic alkyd	19.4	0.5	27.2Y + 7.3R

bonds of the alkyd resin molecule which would result in a higher rate of homopolymerisation of styrene than copolymerisation with alkyd resin – thus causing haziness in the product. To avoid this problem, further experiments of styrenation of this alkyd were conducted by blending 10 parts of tung oil with 100 parts of alkyd resin. For the purpose of comparing the film properties, the conventional styrenated phthalic alkyd was also prepared by blending tung oil with phthalic alkyd with same level as in the case of styrenated non-phthalic alkyd based on maleopimaric acid.

Characteristics of styrenated alkyds

Table 2 shows the characteristics of unstyrenated and styrenated alkyds prepared from maleopimaric alkyd and conventional phthalic alkyd. On the perusal of table, it is observed that acid value increased from 16.1 to 19.3 during styrenation in the maleopimaric alkyd and from 16.6 to 19.4 in the phthalic alkyd. There was greater increase in the viscosity of maleopimaric acid based alkyd as compared to phthalic alkyd after styrenation. There was also a slight increase in colour of the alkyds during styrenation in both cases.

Film properties of styrenated alkyds

The film properties of styrenated and unstyrenated alkyds and red oxide-zinc chromate primers based on styrenated alkyds are shown in tables 3 and 4 respectively.

Drying Time

All the alkyd solutions were applied to mild steel panels by brush and dried in air. Drying time was checked by the touch method for different stages of the coatings, i.e. surface dry, hard dry, and freedom from tack. The improvement in the drying time after styrenation in the air dried films is very significant as is apparent from the results. The surface drying time after styrenation was reduced by a quarter, i.e. from 2 hours to 0.5 hours, the hard drying time from 8 hours to 4 hours and tack-free period from 36 hours to 18 hours. The drying properties of both the alkyds were otherwise the same.

Scratch and rocker hardness

Scratch hardness of the dried films (48 hours, air dried or baked) were checked on tin plate using a mechanically operated 'Sheen' scratch hardness tester. The rocker hardness was tested on glass panels and rocker value determined with respect to glass. Scratch hardness as well as rocker hardness of the baked films were slightly higher values than for the corresponding air-dried films. Significant improvement in the hard-

ness of films was observed due to styrenation. Films of maleopimaric acid based alkyd showed comparatively better hardness than conventional phthalic anhydride based films. The primer films of styrenated alkyd based on maleopimaric acid also showed a better scratch hardness value than styrenated alkyd based on phthalic anhydride.

Flexibility

Flexibility testing of the films were done after 48 hours air drying or baking at 120°C for 30 minutes on a quarter inch mandrel. This test was carried by coating the samples on tin plate. All the alkyd films (styrenated as well as unstyrenated) showed no detachment of the film from the substrate or visible cracks, indicating that all the samples had good flexibility.

Impact resistance

This was carried out on coated tin plates after 48 hours air drying or baking at 120°C for 30 minutes. A weight of 2 lbs was allowed to fall a height of 24 inches and any damage, such as cracking or detachment of the film, was noted with the help of a magnifying glass. All the films passed the impact resistances test.

Water resistance

This was determined by immersing the coated glass panels in distilled water for desired periods. They were then taken out and dried in air. The defects, if any, such as blushing, swelling, cracking, wrinkling and loss of gloss of the air-dried and baked films of styrenated alkyds were studied. No such defects on the films were observed after immersion in water for 48 hours in case of styrenated alkyds. However, the air-dried films of unstyrenated alkyds showed slight loss of gloss after 48 hours and further loss of gloss with slight blushing after 96 hours. Styrenated alkyds of the air-drying type showed loss of gloss after 96 hours of immersion while the baked films remained unaffected.

Acid resistance

The coated and dried glass panels were immersed in 2 per cent sulphuric acid for a specified period. The panels were then taken out gently, washed with distilled water, dried, and films examined for any defects as pointed out above in the water resistance test. The acid resistance of all the alkyd films was generally good. No effect of sulphuric acid immersion was observed in any of the films after 48 hours. However, after 96 hours immersion, all unstyrenated alkyd films (both air dried and baked) showed slight loss in gloss.

Alkali resistance

This was determined by immersing glass panels in 2 per cent sodium carbonate solution. Thereafter the panels were washed with distilled water, dried and observed for any damage as above in water resistance. The styrenated alkyds showed good resistance to alkali.

These alkyd films remained completely unaffected by 2 per cent sodium carbonate solution during immersion for 8 hours whereas the corresponding unstyrenated alkyd films were removed during this period of immersion in alkali. However, during the first 4 hours of immersion in alkali all the films remained unaffected.

Solvent resistance

The coated glass panels were immersed in mineral turpentine oil. After the specified period the panels were taken out, dried in air and examined for any damage to the films as above in water resistance. The resistance to mineral turpentine oil was good for all the styrenated alkyd films, and no effect on these

Table 3
Comparison of film properties of air-dried films of the styrenated and unstyrenated alkyds

Product	Drying time (h)		Hardness		Flexibility and adhesion $\frac{1}{4}$ " mandrel	Impact resistance 2 lbs from 24" height	Water resistance		Acid resistance (2% H ₂ SO ₄)		Alkali resistance (2% Na ₂ CO ₃)		Solvent resistance (M.T.O.)		
	SD	HD	TF	Scratch (gm)			Rock-er	48 hrs	96 hrs	48 hrs	96 hrs	4 hrs	8 hrs	24 hrs	48 hrs
<i>Air dried</i>															
1. Unstyrenated maleopimaric non-phthalic alkyd	2	8	36	1400	14	P	P	4	3	5	4	5	1	5	4
2. Unstyrenated conventional phthalic alkyd	2	8	36	900	10	P	P	4	3	5	4	5	0	5	4
3. Styrenated maleopimaric non-phthalic alkyd	0.5	4	18	1850	28	P	P	5	4	5	5	5	5	5	5
4. Styrenated conventional phthalic alkyd	0.5	4	18	1550	16	P	P	5	4	5	5	5	5	5	5
<i>Baked</i>															
1. Unstyrenated maleopimaric non-phthalic alkyd	—	—	—	1400	20	P	P	5	4	5	4	5	1	5	4
2. Unstyrenated conventional phthalic alkyd	—	—	—	1050	14	P	P	5	4	5	4	5	0	5	4
3. Styrenated maleopimaric non-phthalic alkyd	—	—	—	2000	32	P	P	5	5	5	5	5	5	5	5
4. Styrenated conventional phthalic alkyd	—	—	—	1800	20	P	P	5	5	5	5	5	5	5	5

5 = Film practically unaffected; 4 = Slight loss in gloss; 3 = Slight blushing and loss of gloss; P = Pass; 2 = Heavy blushing and complete loss of gloss; 1 = Partial film lift off; 0 = Complete film lift off.

Table 4
Film properties of red oxide-zinc chromate primer

Sr. No.	Product	Drying time in hours (hard dry)	Finish	Scratch hardness (gm)	Flexibility and adhesion	Corrosion resistance (7 days)	Salt spray resistance (4 days)
1.	Styrenated maleopimaric non-phthalic alkyd based primer	3.0	Matt	1800	P	P	P
2.	Styrenated conventional phthalic alkyd based primer	3.0	Matt	1600	P	P	P

P = Pass

films was observed after 48 hours immersion. The unstyrenated alkyds however, showed slight loss in gloss after 48 hours immersion.

Corrosion resistance

The mild steel panels coated with the paints were air dried for 24 hours followed by baking at 60°C for one hour. The panels were then suspended in a corrosion cabinet. The latter was maintained at 100 per cent relative humidity and temperature cycle of 42° to 48°C for seven days. The panels were examined for any signs of deterioration in the film due to corrosion of the metal surface. Both primer films passed this test.

Salt spray resistance

The paint coated mild steel panels were dried as above and suspended in a salt spray chamber for 4 days. They were then taken out and examined for any signs of deterioration and

corrosion exactly as described in corrosion resistance test. Both primer films passed this test also.

Conclusions

Significant improvement in the drying properties of the alkyds takes place upon styrenation. The hardness and other film properties of the alkyds, such as water, acid, alkali and corrosion resistance are also improved. This is due to the fact that polystyrene has excellent resistance to water, acid and alkali which is partially imparted to the alkyd resin after styrenation. Further improvement in the film properties of the styrenated alkyds can be achieved by drying the films by baking which results in further polymerisation. This significantly improves the film characteristics and general performance of the alkyd resins.

The above results indicate that the styrenated alkyds based on maleopimaric acid may be used in fast air drying coatings.

anticorrosive coatings, industrial finishes, etc., in place of styrenated phthalic alkyds.

[Received 4 July 1984

References

1. Hewitt, D. H. and Armitage, F., *JOCCA*, 1946, **29**, 109.
2. Peterson, N. R., *American Paint J.*, 1948, **32**, 32.
3. Brunner, H. and Tucker, D. R., *J. Appl. Chem, London*, 1951, **12**, 563.
4. Hoogsten, H. M., Young, A. E. and Smith, M. K., *Ind. Eng. Chem.*, 1950, **42**, 1587.
5. Crofts, J. B., *J. Appl. Chem.*, 1955, **5**, 88.

6. Rinse, J. and Korf, C., *JOCCA*, 1949, **32**, 593.
7. Chand, V., Saxena, M. S. and Vasishtha, A. K., *Paint India*, 1976, **26**(11), 10.
8. Saxena, M. S., Chand, V., and Vasishtha, A. K., *ibid.* 1978, **28**(8), 23.
9. Bhow, N. R. and Payne, H. F., *Ind. Eng. Chem.*, 1950, **42**, 700.
10. Heavers, M. J., *Paint Manufacture*, 1958, **28**(1), 5.
11. Bevan, E. A., Heavers, M. J. and Moon, W. R., *JOCCA*, 1957, **40**, 745.
12. Gupta, J. B., Saxena, M. S. and Vasishtha, A. K., *Paint India*, 1980, **30**(7), 13.
13. Shukla, M. C., Saxena, M. S. and Vasishtha, A. K., *J. Oil Techno. Assoc. of India*, 1981, **13**(4), 130.

next month's issue

The Honorary Editor has accepted the following papers for publication in the April issue.

Filtration of surface coatings by C. G. Roffey

Measurement of film thickness by colour comparison using primers with low opacity by M. Camina and W. Bainbridge

Development of wood varnishes from palm fruit fibre hydroxylate (ehéis guineensis) and red onion skin (allium cepa) tannin extract by T. O. Odozi, O. Akaranta and I. U. Ogban

occa meetings

Ontario Section

Can you measure up to the future

The second technical meeting of the Ontario Section's 1984-85 session was held on 17 October 1984 in the Cambridge Hotel, Toronto. Continuing a recently established tradition, this meeting was held primarily for the benefit of our students.

Forty-seven members and guests turned out to listen to Mr David O'Donnell, president and chief executive officer of Sinclair, Valentine and Frye, Canada.

Mr O'Donnell opened by complimenting the Ontario Section for its fine Printing Ink Technology Course and the benefits it has had, and will continue to have, for the industry. He commented that the ink industry was currently undergoing great change and that technology advancements made in the last five years were greater than anything achieved in the previous fifty years.

Encouragement was given to the students in their endeavours as more and more young people were aspiring to positions of responsibility within the ink industry. Mr O'Donnell then gave some examples of the areas of increased sophistication in his company and stressed that their increased commitment to R & D required highly trained and dedicated personnel to achieve success in a very competitive world.

Mr Purnell then presented Mr O'Donnell with a certificate acknowledging his presentation and proposed a vote of thanks. Those present responded in the normal manner.

Dispersion equipment

Forty-eight members and guests were present at the technical meeting held in the Cambridge Motor Hotel on 18 November 1984. The speaker was Mr Gerry Brussard, President of Chemitrade Inc. who gave a presentation on "Dispersion Equipment"

In spite of the fact that his slides were held up by Customs, Mr Brussard was able to overcome this handicap and give an interesting and informative lecture. He described new developments in premixing technology by "Draiswerke", where significant improvements in efficiency were claimed. He went on to describe "direct dispersion equipment" in which the bead or shot mill was connected directly to a mixing and feeding assembly. This enabled dry ingredients, such as pigment, and liquid ingredients such as vehicle and solvent, to be continuously fed into the system in the correct proportions for mixing and dispersion. Savings in increased efficiency and reduced manpower were claimed.

A lively question and answer period ensued, followed by a vote of thanks proposed by the Chairman.

P. Marr

Natal Section

Concepts in emulsion polymerisation

On Wednesday 7 November 1984, Mr Terry Say, technical director of Bevaloid (SA) (Pty) Ltd, and current Chairman of the Natal Section, gave a lecture entitled "Concepts in emulsion polymerisation".

Mr Say first outlined the basic concepts of addition and condensation polymerisation and then detailed the advantages and disadvantages related to each technique. Components of an emulsion polymerisation system were listed with the resultant effect of monomer composition on paint properties. The importance of surfactant balance was stressed, with greater amounts needed when the surface to volume ratio increased. Paint properties affected by emulsion characteristics were listed in detail and the effects of catalysts, molecular weight modifiers, pH buffers, biocides and coalescing solvents were explained. Finally, the kinetics of emulsion polymerisation in relation to the Smith-Swart and Medvedev-Sheinker theories were discussed.

continued overleaf

The lecture was well documented with slides and a lively question time ensued from the attentive audience. The vote of thanks was proposed by Mr N. Grey who also thanked Messrs Bevaloid for sponsoring the evening's refreshments.

R. Philbrick

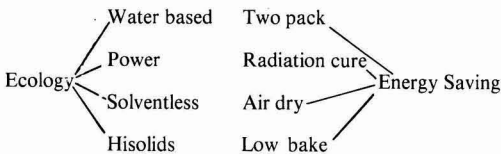
Manchester Section

Recent developments in synthetic resins

On Monday 12 November 1984, seventy members and guests of the Manchester Section attended a lecture by Mr A. G. North of Cray Valley Products entitled "Recent developments in synthetic resins". The lecture at the Georgian House, Blackrod, was followed by an excellent buffet sponsored by Cray Valley Products.

Mr North opened this talk by defining paint as coloured resin and proceeded to apply the doctrine of energy, ecology and economy. The ecological aspects of paint are to a large extent concerned with the elimination or reduction of solvent; the saving of energy is of paramount importance in all industrial systems. Any combination of answers to these two problems which results in economy must be of interest.

Mr North produced a chart illustrating this point.



Durability, resistance and appearance of the resulting paints, are all factors contributing to performance which must be taken into account.

If the two sides of the chart are cross referenced then the areas of interest should be highlighted.

Water-based two pack systems do exist but would seem to have a limited future. Water-based radiation cure systems seem to be of limited application.

Water-based air drying systems are used extensively as emulsion paints. Water-based low bake systems are showing steady improvement and have a good deal of scope for further development.

Powder coatings do not lend themselves to two pack systems. Radiation cured powder coating are not energy efficient as the powder must be melted prior to curing. Air drying powder coatings are not realistic. Low bake powder coatings are the most attractive area for future development, emphasising the need to decrease the melt temperatures of the polymers involved.

Solventless two pack systems, such as p.u., are already significant but there is doubtless room for expansion in this field. Solventless radiation cured systems are already regarded as a standard form. Solventless air drying systems are as old as the industry, i.e. linseed oil. An area here for development, using reactive diluents such as pentadiene acrylate, although the current limitation is the long wet time. Solventless low bake systems offer no obvious advantages.



high speed benefits

High speed electrostatic paint application from Graco Soprea brings high speed benefits – fast!

Greater paint savings, better finish, lower environmental pollution, virtually maintenance-free – benefits reinforced by our latest air-bearing technology, a world first.

Whether updating your present system or going automatic for the first time, you need to call the leaders – Graco Soprea!

Graco Soprea Wednesfield Road
Wolverhampton
West Midlands WV10 0DR England
Tel Wolverhampton (0902) 51924
Telex 339237

Reader Enquiry Service No. 369

occa meetings

Both hisolids and two pack air drying systems find application in maintenance coatings.

Other permutations are possible; water-based powder coatings offer certain advantages. A fine aqueous dispersion of powder reduces the dust hazard, improves the flow of the system and offers scope for low temperature curing.

Radiation cured two pack systems offer the possibility of inter-penetrating polymer networks, which is an obvious area for development.

Other areas of activity on the ecological front involve, the avoidance of formaldehyde, and developments involving a move away from acid and amine systems.

In the field of energy conservation solvent released from stoving finishes can be used to fuel the ovens, which gives scope for the use of larger quantities of cheaper solvents – a possible area for development and NAD resin systems.

For the future it would seem sensible to base new resin developments on renewable resources, which would indicate alkyd resins.

Other areas for development include:

- Hi solids coatings where rheology needs changing to avoid sag problems resulting from the lack of viscosity build up due to solvent loss.

- New thixotropic resins, with a gel strength which is not temperature dependent, can be blended with alkyds to give a range of properties.

- Resins suitable for use with aluminium dryers to give better exterior exposure with good clear varnishes for wood.

The vote of thanks for this most interesting lecture was offered by Mr Roy Wilkinson.

R. G. Handley

Hull Section

The British Board of Agreement – aims and objectives

The following is a report of the technical meeting which took place on 12 November 1984. The speaker, Mr L. Airey described the historical background to the British Board of Agreement (BBA) showing how it related to sister organisations in the EEC, South Africa, Australia and Canada. The connection between BBA and the British Standards organisation was also explained.

Many examples were given of areas of industrial technology in which BBA is involved, showing that the range of materials and systems for which certificates have been issued is very large and diverse indeed. Typical testing and certification costs were described for an exterior masonry paint.

continued overleaf

AT YOUR SERVICE to develop finer, more durable products

The fast, economical weather tests of **SUB-TROPICAL TESTING SERVICE, INC**

established 1929

Sub-Tropical Testing Service is known and utilised world-wide

Our 55th Year



Send for free
Sub-Tropical colour
brochure

Sub-Tropical Testing gives fastest Natural Weather tests available for ★ paints ★ chemical coatings ★ plastics ★ textiles ★ fabrics ★ related products ★

Wir waren die ersten, welche einen Prüfdienst dieser Art für Lacke, Kunststoffe, chemische Beschichtungen, Stoffe und Gewebe aller Art, Farbstoffe und verwandte Erzeugnisse in den U.S. möglich machten.

Mr C. Hubbard Davis, Founder, Sub-Tropical Testing Service, Inc. (1904-1977)
PO Box 560876, 8290 S.W. 120th Street, Miami, Florida, U.S.A. 33156

Phones: (305) 233-5341
Cable: SUBTROP, Miami

In many cases, BBA Certificates may be used as an aid to marketing. Thus, today, where specifiers are inundated with new products and advertising literature on a wide range of materials, a BBA certificate indicates a certain technical standing for a product.

The presentation was followed by one of the liveliest discussions heard at the Hull Section for some time. By the end of the

evening, everyone had a much clearer understanding of the function of BBA.

The vote of thanks was proposed by Dr N. Reeves. The meeting was attended by 18 members and guests.

P. A. Bentley

news

New ICI Organic Division sales headquarters

The opening of the new UK sales headquarters of this division at Bolton marks further integration of the colours business of PCUK of France with ICI. The Bolton complex is a modern purpose built building, formerly the Alliance Dye & Chemical headquarters, the selling arm of PCUK in Britain, which was built in 1981.

Before outlining the changing pattern in the colour consuming industries, Jim Keaton the marketing director introduced the highly experienced sales team; most of whom had international experience. The acquisition of PCUK in 1982 had doubled the ICI colours product range to nearly 3,000 dyes, pigments, and colour auxiliaries and the new organisation will combine the sales activity of ICI Blackley and ADC, backed by first rate modern technical service facilities.

In a very comprehensive survey of the changing climate in the colour user industries covering textiles, surface coatings including inks and plastics it was pointed out that the large scale business in these areas was dominated internationally by Europeans. The six major companies were ICI, and three German and two Swiss companies, all of whom manufacture in other countries including the USA and the Far East.

The general manager Peter Macdonald in outlining the re-organisation stated that it was their aim to restructure the colours business more closely around the needs of the customer; to focus strongly on customer philosophy, and to give a useful selling structure which will satisfy customers and set ICI apart from other suppliers.

By computerising all internal ordering and despatch functions it is possible to transmit



The new ICI Organics Division sales headquarters building at Bolton, Lancashire, UK.

all the orders received to the despatch warehouse at Heywood within one minute, then to finalize all the required paperwork in three minutes. At present from 1,318 customers they receive 50,000 orders per year and despatch 70 tons of material each day from Heywood. This capacity will be increased in 1985, still however with the same main object, which is: to deliver what you want, where you want it, and when you want it at the most economical price.

The assistant sales manager Richard Walsham then supervised a tour of the very well appointed laboratories, introducing the technical staff in charge. A short and interesting survey of the range of new products was given by Roy Falden and Eric

Hartley, who with Richard Walsham are well known members of the Manchester Section.

In conclusion, it was a very efficient and highly informative excursion to a company that have never rested on their laurels, but have continued producing new products in a highly sophisticated competitive field, whilst at the same time still focussing on the needs of our very complex industry. It all seems a far cry from my early days, when monastral blue was bought in 7 lb tins, and kept in the chief chemist's office to be weighed out with a tablespoon as required.

N. H. Seymour

No go in the USA, but in Europe maybe

NL Industries, Inc. have announced that they would not pursue their acquisition of American Cyanamid's titanium dioxide pigment business because the Federal Trade Commission voted, with chairman Miller dissenting, to file a suit challenging the transaction.

When the proposed acquisition was announced in October 1984 NL indicated it would consider expanding the American Cyanamid titanium dioxide plant located in Savannah, Georgia, USA. NL now plans to increase its own capacity, using NL's proprietary chloride process technology. Sites being considered by NL for expansion are its titanium dioxide plants in Canada and Europe.

Fred Montanari, executive vice-president of NL Industries and president of NL Chemicals, stated: "NL is disappointed that the proposed acquisition will not occur. Despite the FTC decision, NL remains fully committed to the titanium dioxide pigment business and intends to expand its capacity to supply the needs of titanium dioxide customers".

Reader Enquiry Service No. 31

BP subsidiary closes down

Bakelite UK Ltd, a wholly owned subsidiary of BP Chemicals Ltd, has ceased manufacture. Closure resulted in the loss of some 350 jobs at the Tyseley, Birmingham site.

Continuity of supply of some products will be ensured by licensing the formulations of certain moulding materials for manufacture by Vynckier of Belgium, a wholly owned subsidiary of GEC, and certain FR2 VO copper clad phenolic paper laminates for manufacture by Dynamit Nobel. The market will be supplied through the UK Marketing Groups of the two companies.

BP Chemicals Ltd acquired Bakelite UK Ltd in 1977. It was then the Thermosetting Division of Bakelite Xylonite Ltd, producing phenolic resins, moulding materials and industrial laminates. The phenolic resins business was transferred to BP Chemicals, Barry Division, in 1983.

Considerable overcapacity in moulding materials in Europe has resulted in severe competition from cheaper imported material with the result that Bakelite had been unable to get an economic price for its products.

Reader Enquiry Service No. 32

ICI appoints new 'Fluon' distributor

Lawter International Ltd has been appointed UK distributor for small quantities (maximum 200 kg per order) of 'Fluon' PTFE lubricant powder grades from ICI.

In this positive move to expand a growing area, the combination of ICI's technical resources and Lawter's specialised expertise in supplying synthetic resins, printing ink vehicles and other materials to the coatings industry will, it is claimed, both improve the service offered to 'Fluon' users and extend the range of materials available from Lawter.

Reader Enquiry Service No. 33

Chemical distribution appointment

The UK's largest chemical distributor, Ellis & Everard (Chemicals) Ltd, has been appointed to handle selected products from the Bevaloid range of chemicals used in the control of industrial processes.

These products include non-silicone defoaming agents, dispersing agents and other performance chemicals with wide applications throughout chemical process industries.

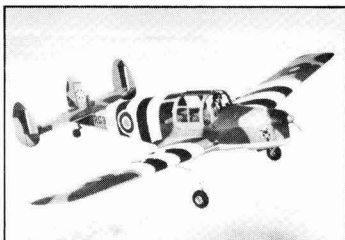
Bevaloid defoamers control foam during the production and use of paints and adhesives, the production of paper, in textile dyeing and other manufacturing processes in which foam reduces plant capacity or damages final product quality. Bevaloid dispersants have numerous applications with clays, pigments and fillers, including the

manufacture of paint, adhesives and paper. Other products covered by the agreement include textile sizes and various speciality surface active chemicals.

The Bevaloid range will complement existing products supplied by Ellis & Everard, particularly to the paint industry, including silicone defoamers, hypochlorite, formic acids and a range of bleaches.

Bevaloid, a member of RTZ Chemicals, is based at Beverley, Humberside, and specialises in solving industrial processing problems including foam control, slurry dispersion and water hardness control.

Reader Enquiry Service No. 34



The refurbished Miles Messenger

Valentine helps revive World War II plane

Valentine has supplied the paint and technical support to refinish one of only two remaining World War II Miles Messenger aeroplanes. This plane had been grounded for seven years, during which time, the Bristol Plane Preservation Unit decided to restore it and make it airworthy. Eighty-one Miles Messengers were built between 1943 and 1950; twenty of which were used by the RAF during the war.

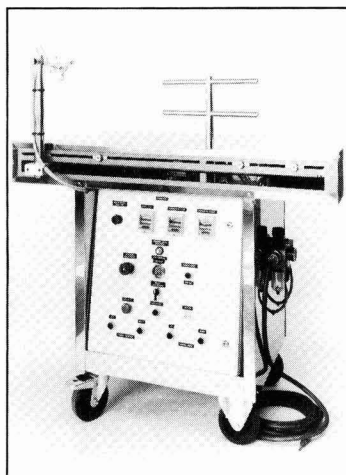
Capable of flying at speeds as low as 30 mph, the Messenger was a useful aircraft for observation and reconnaissance. Its ability to take-off and land in short, confined spaces added to its usefulness, and made the Messenger Field Marshall Montgomery's preferred aircraft just after D-day. It was used by Monty and his staff until the end of the war.

Reader Enquiry Service No. 35

products

Pneumatic Test Panel Spray System

A pneumatically operated, automatic test panel spraying unit which is said to be ideally suited for use in hazardous locations is now available. The SFS model 1000/01 from Spray Finishing Systems Ltd is British designed and is claimed to cost less than half



SFS's new test panel spraying unit

that of comparable, electro-mechanical equipment.

While special requirements can be accommodated, standard units spray a panel area of 610 mm (24 in) wide by 457 mm (18 in) high can be operated fully automatically or manually overridden. They suit a wide variety of applications in research and development, routine sampling, batch testing and colour matching.

Pneumatic operation of the model 1000/01 means a lighter weight unit that can be manoeuvred through standard door apertures, and the wheeled carriage and controls are encased within a stainless steel cover for protection and ease of cleaning.

In use automatic or cup spray guns can be mounted and an actuating cylinder is provided to operate the trigger of a manual gun. Quick adjustment is provided for spray distance and traverse speed. Dwell time between strokes may be set between two to 30 seconds and the number of coats selected between one and 99. Only a 7 bar dry air supply is required.

Reader Enquiry Service No. 36

Anionic Dispersant for Emulsion Paints

Tambour Ltd (Israel) has, for the past year, been using its own dispersant (Disperse-One) in the manufacture of its emulsion paints. Disperse-One was developed in Tambour's R & D laboratory since it was felt that money could be saved by making its own pigment dispersant.

The new product is said to be more efficient than most of the dispersants found on the European and North American Markets.

Disperse-One is also said to be substantially cheaper than other dispersants and its

manufacture to be simple and straightforward. It is synthesized from readily available raw materials; the process being carried out batchwise, in any common resin kettle, and under atmospheric pressure.

Typical product data are:

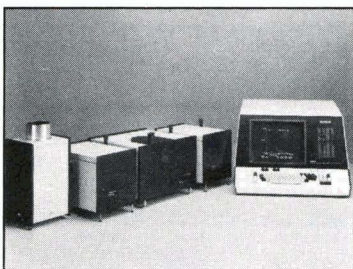
Type	Polycarboxylic
Counter-ion	Na ⁺
Non-volatiles (%)	44-46
Ph (at 1% concentration)	0.5-2.0
Appearance	Amber liquid (slightly hazy)

Reader Enquiry Service No. 37

Fluorescence

Glen Creston have introduced a total of nine different Spectrofluorometer systems which make up the SPEX FLUOROLOG-2 series. Each is controlled by the new DMIB Spectroscopy Laboratory Coordinator.

Research grade performance is said to be provided by all the nine instruments but one has the opportunity of selecting the most suitable instrument for one's application as Glen Creston offer the choice of single or double spectrometers, 150 or 450W Xe lamps, and cooled or uncooled detectors. A wide range of accessories for polarization, phosphorescence and kinetics experiments are also available, and photon counting is standard for all systems.



The SPEX FLUOROLOG-2 from Glen Creston

New catalogues on the FLUOROLOG-2 and DMIB Spectroscopy Laboratory Coordinator are now available.

Reader Enquiry Service No. 38

people

Mr David Winterbottom has been appointed group deputy chief executive of Evode Group plc. Mr Winterbottom will continue to be responsible for the Paints and Plastics Division. In addition, the managing directors of the Adhesives and Sealants Division at the

Roofing and Insulation Division will report to him in his new senior role.



Dr K. G. Seifert, director of Hoechst AG's Zentrale Direktionsabteilung, has been elected as a non-executive director to the board of Hoechst UK, the British subsidiary of Hoechst AG, one of the world's largest chemical companies.



Dr K. G. Seifert

Unmistakably



Adhesion Resins

+ LTH
+ LTW

British Standards

The publications listed below are new and revised British Standards. An existing BSI publication bearing a number identical to one announced below is automatically withdrawn. In all other cases of supersession, details are given in the appropriate announcement and a corresponding entry appears in the "Standards withdrawn" section.

BS 3900:
Methods of test for paints
BS 3900: Part A10: 1985 =ISO 3233
Determination of volume of dry coating (non-volatile matter) obtained from a given volume of liquid coating.
Describes the procedure for evaluating the non-volatile matter in paints. (See also BS 3900: Part B2.) Supersedes BS 3900: Part A10: 1976.
8 page Gr 5
BS 3900: Part F12: 1985 =ISO 7253
Determination of resistance to neutral salt spray.
Describes a procedure for evaluation corrosion resistance of paint films. (See also BS 3900: Part F4.) No current standard is superseded.
6 page Gr 4

BS 4359:
Determination of the specific surface area of powders.

BS 4359: Part 1: 1984
Recommended gas adsorption (BET) methods
Recommends three methods, plus the necessary outgassing, for determining the specific surface of a powder by measuring the quantity of gas which would cover the surface with a single layer of adsorbed gas molecules. Supersedes BS 4359: Part 1: 1969.
28 page Gr 7

Amendments

3262: 1976
Specification for hot applied thermoplastic road marking materials.
Amendment No. 4 Gr 2 AMD 4754

Special Announcements

EN 53: 1974 Paints and varnishes. Determination of the danger classification by flash-point (closed-cup method)
The above European Standard reproduced, with some modifications, the text of ISO 1516: 1973. It was implemented as a dual-numbered British Standard as BS 3900: Part A8: 1976. Since then, ISO 1516 has been revised by ISO/TC 35 and the second edition was published in 1981. CEN has now decided to withdraw EN 53: 1974 as this new edition of the International Standard is a satisfactory equivalent. Accordingly, ISO 1516: 1981 will be implemented as a revision

of BS 3900: Part A8. This new edition will be published in 1985.

Proposals for withdrawal

244 & 290: 1962
Turpentine for paints
Obsolete

Standards withdrawn

4699: 1971 PTC/12
Method for determination of specific gravity and density of petroleum products (graduated bicapillary pycnometer method)
Superseded by BS 4699: 1985

5093: 1974 PTC/1
Method for the determination of relative density and density of petroleum products by the capillary-stoppered pycnometer method
Superseded by BS 4699: 1985

New ISO Standards

ISO 4618:
Paints and varnishes - Vocabulary
ISO 4618/2: 1984 Terminology relating to initial defects and to undesirable changes in films during ageing 18 page K
ISO 4618/3: 1984 Terminology of resins 9 page F

better



Unmistakably better - cross-hatch adhesion test comparison proves it. Paints and lacquers with only small additions of Adhesion Resin LTH (solid) or Adhesion Resin LTW (liquid), apart from good light and weather resistance, attain significantly enhanced adhesion to metal and mineral substrates, and also to plastics.

Find out more about our new development, Adhesion Resin BL 305.

**huls (U.K.) Ltd., Central Court,
1b Knoll Rise,
Orpington, Kent BR6 0JA**

Please tell me more about
 Adhesion Resins LTH/LTW
 Newly developed Adhesion Resin BL 305

Name _____

Position _____

Company _____

Address _____

Telephone _____

**CHEMISCHE WERKE HÜLS AG
D-4370 Marl, F. R. Germany**

huls

OCCA Conference 1985 – New substrates, new materials, new problems?

As already announced the Association's Biennial Conference will take place in Edinburgh 26-29 June 1985. Twenty-three papers on the theme will be presented in four sessions in the mornings and afternoons of Thursday 27 June and Friday 28 June. Details of both the technical programme and the social programme were given in the registration form, a copy of which was enclosed with each issue of the February *JOCCA*. In addition the technical programme appeared on page 53. Further copies can be obtained from Priory House; photostats of the registration form will be acceptable but all applications must be accompanied by the appropriate remittance.

Accommodation is being held for the Association until 1 April for delegates at both the Dragonara and Grosvenor Hotels and the Pollock Halls of Residence, although every attempt will be made to find accommodation for delegates after that date. Expotel are also holding a limited number of rooms and the Association has booklets on alternative accommodation for delegates wishing to make their own arrangements.

The social programme is a very full one in honour of the 50th Anniversary of the formation of the Scottish Section. It includes a special entertainment by that Section, coach tours to places of interest, a Jacobean banquet, a reception for overseas visitors and the Association Dinner Dance on the Friday evening, together with a golf tournament for the Sam Sharp OCCA Conference Golf Trophy.

Further summaries of papers and biographies of authors

Performance of a novel corrosion inhibiting pigment of low toxicity, in ferrous metal primers, applied to marginally prepared surfaces

P. A. Draper

Summary

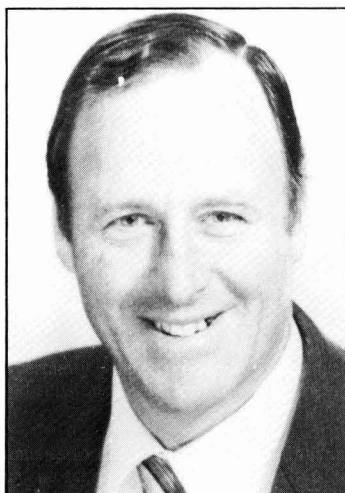
The new ferro-organic pigment shows promise as a non-toxic replacement for conventional anti-corrosive pigments. Details of laboratory evaluation by means of accelerated testing of the pigment are presented. The protection afforded to abrasive blast cleaned steel is compared to that of wire brushed, previously rusted steel. In addition, the results of a limited amount of outdoor exposure are discussed. The pigment has been useful in both epoxy and alkyd binders and the paper deals with the experimental work carried out to produce starting formulations of primers in these mediums which have performance at least equal to those based on pigments such as red lead, zinc chromate and zinc phosphate. A tentative theory for the mechanism of the corrosion inhibition is also advanced.

Biography

Mr P. A. Draper obtained his BSc in 1960 with majors in Chemistry and Physics. He also has a diploma in management and administration.

From 1955 to 1959 he worked as a laboratory assistant with African Bitumen Emulsions (Pty) Ltd. In 1960 he became their chief chemist and during this period their complete epoxy product range was developed as original work in their Durban laboratories. This included a range of anti-corrosion coatings, concrete protection wall, floor coatings and powder coatings.

In 1969 he co-founded a company specializing in the manufacture and application of specialist construction resins and surface coatings, and served as technical director until 1981.



P. A. Draper

Since then he has established a consultancy practice in the field of surface coatings and construction resins. In this capacity he is responsible for specification writing, QA/QC and problem solving in the coating industry. A project led by the consultancy is the subject of the paper i.e. the evaluation of the new pigment in order to assess its commercial potential.

Mr Draper has been a member of OCCA since 1959 and was admitted as a Fellow in 1981. He is also a member of the S.A. Corrosion Institute, the National Association of Corrosion Engineers (NACE) and the South African Society for Quality Control.

Novel corrosion inhibitors

Z. Kalewicz

Summary

The necessary role of primer in any coating

system used for corrosion protection of iron and steel is well recognized.

The so-called zinc-rich primers, which are highly loaded with metallic zinc (zinc dust) present some disadvantages associated with their application: high cost, poor weldability, and a tendency to blister when exposed to aggressive, industrial atmospheres.

The paper describes the composite zinc-containing pigment composed of an electrically conducting nucleus surrounded by particles of metal zinc. This pigment behaves anodically to all corrodible steels and thus protects them from electrochemical corrosion. Di-iron phosphide has been used as the material for nuclei of this inhibitor pigment. The metal zinc deposited around the particles of di-iron phosphide diffused inside resulting in the formation of composite pigment particles; each particle constituted of an electrically conducting nucleus, a diffused interface and finely dispersed particles of zinc. The results of both short-term accelerated tests (salt-spray and humidity) and on natural weathering are given. The mechanism by which these inhibitors are believed to operate in paint film is described and the advantages of technology and application are discussed.

Biography

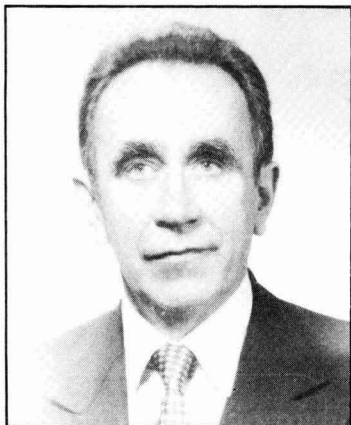
A native of Kielce, Poland, Mr Z. Kalewicz is the chief engineer in the R & D laboratories of Derivery Ltd Co., France.

Mr Kalewicz holds a BS degree in physical chemistry from Jagiellonian University of Cracow.

After the research works on furfuryl alcohol resins, he received his MS degree from the Institute of High Polymers Chemistry in Warsaw and joined the Institute of Precision Mechanics, Warsaw, as a senior group leader in the organic coatings laboratories.

Mr Z. Kalewicz has three patents to his name and has authored more than 30

technical papers, most of them dealing with anticorrosion aspects of coatings technology. He is a member of OCCA, with the professional grade of FTSC, and is a member of the National Association of Corrosion Engineers.



Z. Kalewicz

New developments in selfpolishing antifoulings

C. M. Sghibartz

Summary

Since their introduction in the early seventies, selfpolishing antifouling paints have steadily increased their share of the market at the expense of the old, long life antifoulings.

This paper deals with the latest developments in this interesting and competitive field.

Biography

Dr C. M. Sghibartz studied Chemistry at Imperial College, London, graduating with



C. M. Sghibartz

BSc (Honours) in 1974. He continued his studies at King's College, London, completing his doctorate in 1977.

He was then employed by International Paint, Felling, England, where he worked for five years.

Dr Sghibartz joined Jotun Marine Coatings over two years ago in the capacity of research and development manager, antifoulings.

Author of numerous papers, patents and articles on antifouling paints, Dr Sghibartz is spokesman on technical matters for Jotun Marine Coatings worldwide.

Colouration of UV Curing Systems

V. Kaden and P. Eckert

Summary

Based on practical work, a general overview of possibilities to colour UV systems is presented. The following groups of materials are considered:

- Organic powder pigments
- Special preparations
- Solvents soluble dyes

For each of these groups their influence on for example, the choice of resin, the dispersion process, storage stability as well as other applicational properties are discussed and comparisons with conventional systems presented.

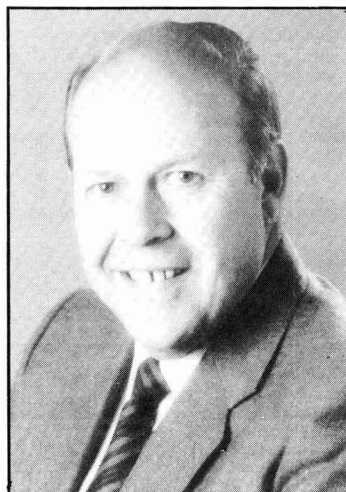
Biography

Born in 1932 in Basle, Mr P. Eckert studied chemistry at the ETH in Zürich and textile chemistry at the Institute of Technology in Winterthur (Switzerland). He joined Ciba at Basle, Switzerland in 1958 as a chemist at the Pigment Research Department.

From 1960 he held various responsibilities in the Pigment and Dyestuff Application Department in paints, inks and allied fields. From 1970 until 1981 he was head of the Ink Application Group of Ciba-Geigy, Basle, and from 1982 until 1984 he was department head of Application and Quality Control at Ciba-Geigy Pigments, Paisley, Scotland.

Since 1984 Mr P. Eckert has been responsible for the Paint and Ink Industry and Application of Ciba-Geigy Pigment Section, Switzerland.

Born in 1938 in Germany, Dr V. Kaden was educated at the Technical University of Berlin and the Technical University of Stuttgart. He gained a PhD from "Forschungsinstitut für Pigmente und Lacke e.V." on "Surface Phenomenon on Pigment Surfaces".



P. Eckert



Dr V. Kaden

Since joining Ciba-Geigy, Basle, in 1968 Dr Kaden has been involved with a wide variety of technical activities associated with the pigments and dyestuffs business, often in close collaboration with the R & D functions. His main fields of activities have been in the printing ink and paint sectors where he has made a special study of the dispersion process. Previous papers published have been on the adsorption and desorption of macromolecules and more recently (FATIEPEC, Budapest 1978) on the dispersion of pigments. He serves as a committee member of a DIN working party on test methods and is a member of the "Schweizerischen Vereinigung der Lack- und Farbenchemiker".

At present Dr Kaden is on secondment to Ciba-Geigy, Paisley, where he is involved with the setting up of the international technical service function.

Eastern Branch

Annual skittles match

The Annual Skittles Match was held at the Murrayfield Indoor Sports Centre, Edinburgh on Friday 19 October 1984 where the Newton Cup was retrieved by the West of Scotland Captained by Dr S. G. Lawrence with a score of 1,860 points against a total of 1,796 points obtained by the East of Scotland team captained by Nigel Baird. The full results were as follows:

Individual Prizes

<i>1st Lady</i>			
Louise Kirkwood	West	160	points
<i>2nd Lady</i>			
Lyn Robertson	East	154	points
<i>3rd Lady</i>			
Jacqueline Henderson	West	150	points
<i>Booby</i>			
Ann Flood	West	83	points
<i>1st Gent</i>			
Alan Baird	West	231	points
<i>2nd Gent</i>			
Denis Gibson	West	218	points
<i>3rd Gent</i>			
Volker Kaden	West	212	points
<i>Booby</i>			
Gunther Wuchner	West	137	points

It seems reasonably clear that the West were successful in retrieving the trophy by packing their side with visiting stars namely Volker Kaden and Gunther Wuchner from Skittle Clubs Basle and Wehr respectively. It remains to be seen what the reaction of the East will be next year.

A very enjoyable night was had by all. The organisers would like to thank the following for donating prizes: R. G. Gardiner (Alexander G. Paterson Ltd), A. Gibson (Alexander Ferguson & Co), A. Hunter (Samuel Banner), W. Jack (Tioxide UK Ltd), A. McKendrick (Craig & Rose PLC), J. Wilson (Ciba Geigy PLC) and Esso Chemicals.

Dr J. H. Coy

Obituaries

F. D. H. Sharp

It is with regret that we record the death on Tuesday 5 February 1985 of Mr F. D. H. Sharp (Chairman of the London Section and a former Chairman of the Irish Section) at the age of 50. The funeral took place on 13 February and was attended by many of his colleagues as well as representatives from the Association, the London Section, and other Sections.

The following tributes have been received:

N. A. McInerney writes:

It was with a great sense of shock and much sadness that we learned of the sudden death of our Past Chairman and friend Mr David



F. D. H. Sharp

Sharp. His widow Barbara and family have requested friends to give a donation to the British Diabetic Association instead of sending flowers.

David's departure leaves a void that will never be filled. He leaves an unforgettable memory with us of a talented man who had many different qualities to suit whatever job he had in hand, whether it was as top salesman or OCCA function organiser. His loyalty to his company, his kindness and his ever present sense of humour were renowned. "Ar dheis De go raibh a anam" – an Irish prayer used at a sad time such as this which wishes David happiness and peace with God.

J. D. Sanders writes:

David and I first met in 1952 when we were both teenagers and he was an assistant in the wool laboratory at Bradford. Even in those days he was larger than life and there was a constant flow of backchat with anyone who happened to come within earshot. He had joined Geigy from Giggleswick School where he had been a boarder and had excelled himself at rugby and cricket.

In course of time he became a representative and moved to Ireland. He transferred from dyestuffs to pigments and after a number of years returned to the UK, finally moving from Scotland to the London area in 1978. During this time David accumulated an astonishingly wide circle of friends and acquaintances. There was nothing calculated or self-interested in this – he just enjoyed people.

He was devoted to OCCA, becoming Chairman of the Irish Section in the mid-60s and was a member of Council for many years. At the time of his death he was Chairman of London Section.

Stories about David abound. On one occasion when David was visiting Paisley from Ireland he was taken to hospital with a

diabetic attack. A colleague called on him and expected him to be horizontal and comatose. Far from it – there he was, large as life, reading out jokes from *Playboy*, with nursing staff and patients in stitches.

On another occasion I remember travelling with a number of colleagues from Glasgow to Manchester by air one wintry evening. Fog descended and we were waiting silently in the coach with 20 or 30 other people ready to move off to Prestwick. David must have heard what was going on as he suddenly appeared, picked up the driver's hat from his seat and made as if to drive us away. He kept the whole coach in hysterics for 15 minutes, when he vanished as quickly as he had come.

Devoted as he was to his family one felt at times that he would willingly have spent all his waking hours, and that was most of them, in the company of his customers. It could certainly be hard to keep up with him. He met me one evening at Watford station and we called for a quick one at some little place he had recently discovered. Sure enough a customer appeared – not even one of his – and we were still at it at the customer's home at 2 am David collected me from my hotel at 6.45 am and in the course of some 300 miles we made three customer visits and had dinner with one of them afterwards in the wilds of Essex, another 2 am finish. It took me a fortnight to recover, but there was Sharpie bright and cheerful on the 'phone next day to see if I had got back safely.

David's friends and colleagues will remember him as a spontaneous, endearing, unpretentious person. He was never afraid to speak his mind and did not suffer fools gladly. He was a true professional. His zest for life, his love of people and his enthusiasm for his job were without parallel. We shall all miss him greatly.

D. H. W. Lovegrove

H. J. Clarke writes:

It is with much sorrow that we record the death of David Lovegrove who died on 30 January 1985 at the age of 52.

David who joined Carrs Paints Ltd in 1948 was a much loved and respected member of the Midlands Paint Industry. He joined OCCA and the Birmingham Paint Varnish, Lacquer Club in 1962 (He was president of the latter in 1972-73 and Society Representative to its Federation in the States since 1975).

He contributed much to the Industry and was always a very happy friend to many people, not only in the Paint Industry but also to many users of paint. His hobby was gardening, about which he would always offer advice when asked. He will be sadly missed.

David is survived by his wife Margaret, his two daughters Karen and Sara, and son Robert.

SURFACE COATINGS

VOL I-RAW MATERIALS AND THEIR USAGE

Prepared by **OCCA Australia**

As a consequence of the comments and criticisms of the first edition of "Surface Coatings" (1974), it was decided to produce a second edition with a different approach. While it has again been designed to serve as a guide and a reference document for students, it is also intended to provide an up-to-date, in-depth treatment of all relevant areas of paint technology.

The work is presented in two volumes, the first extensively reviewing the raw materials used in surface coatings, and the second the technology of the products that use them. Volume 1 will also be of considerable benefit to students, technologists and others in related industries such as inks, adhesives, ceramics, textiles and cosmetics, and raw material suppliers. It provides an excellent introduction to polymer science, pigments, solvents and additives. This edition reflects the movement towards aqueous systems: the chapters on alkyds have been reduced in this edition from six to three, and the four solvent chapters combined. Conversely the emulsion chapters have been doubled to six, and three new chapters on aqueous resins added. Volume 2, whilst retaining the basic manufacture, application and technology coverage, is based on completely updated contributions. There are additional chapters on lacquers, powder coatings, UV-cured coatings and decorative paint selection. Reflecting the increasing impact of computers, there are new chapters on automated colour matching and applications in resin and coating formulation.

Volume 1 is available by placing orders (prepayment only) through the Oil & Colour Chemists' Association at £27.50 (inc. p&p in the UK) plus £2.50 for orders sent overseas by surface mail.

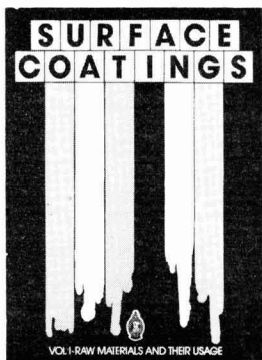
Volume 1 - Hardback - 408 pp.

Contents

The Past, Present and Future of the Surface Coatings Industry
 Introduction to Polymer Science
 Vegetable Oils
 Oleoresinous Media
 Alkyd Resin Technology
 Manufacture of Alkyd Resins
 Applications of Alkyd Resins
 Polyesters
 Amino Resins
 Phenolic Resins
 Polyurethane Resins
 Epoxy Resins
 Water Dispersible Epoxy Coatings

Silicone Resins
 Acrylic Solution Resins
 Emulsion Polymerization Theory
 Emulsion Properties 1:
 Effect of Monomer Composition
 Emulsion Properties 2:
 Effect of Water Phase and Particle Size
 Emulsion Properties 3:
 Film Formation
 Emulsion Polymers: Manufacture and Testing
 Applications of Emulsion Polymers
 Water-Reducible Resins

Water-Soluble Polymers
 Solvents
 Inorganic Pigments
 Titanium Dioxide Pigments
 Organic Pigments
 Extender Pigments
 Paint Driers
 Paint Additives
Contributors and Reviewers
Appendix: Useful Data and Conversion Tables
Index



To: Oil & Colour Chemists' Association
 Priory House, 967 Harrow Road, Wembley, Middlesex HA0 2SF, UK

Please arrange for me to receivecopy/ies of "SURFACE COATINGS", Volume 1 Raw Materials and their Usage at £27.50 each (inc. p&p in the UK) plus £3.00 for orders sent overseas, at the following address:
 (BLOCK CAPITALS)

.....

I enclose remittance (payable to OCCA) for £



Tailor-made preservation with MERGAL®

for example: in-can preservation

- MERGAL® K6N suitable for the preservation of all types of paint and glue
- MERGAL® K7 for products which must comply with the BGA XIV recommendations or which must be formaldehyde-free
- MERGAL® K8 preserving agent with enhanced fungicidal effect
- MERGAL® KM 206 highly concentrated preserving agent for use in very small quantities
- MERGAL® AF powdered product. Particularly suitable for solid mixes, e.g. for mould prevention treatment

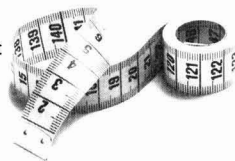
for example: fungicidal protection

- MERGAL® S88 fungicide and algicide for darker colours. Can be supplied in powder or paste form
- MERGAL® S89 universal fungicidal and algicidal powder
- MERGAL® S95 universal liquid fungicide and algicide
- MERGAL® S96 fungicide and algicide for solvent-containing systems

Take advantage of the extensive experience of our laboratories. Our technical service department will be pleased to advise on the benefits of preservation of your products with MERGAL®.

Coupon

Use the coupon to request a consultation and information material. You will get a reward.



Name _____

Position, Department _____

Address _____

JO 1/85

Riedel-de Haën

Aktiengesellschaft
Wunstorfer Str. 40, D-3016 Seelze 1/Hannover
Federal Republic of Germany
Telephone (51 37) 7 07-216, Telefax (51 37) 9 1979
Telex 9 21 295 rdhs d

In other countries we are represented by the sales organization of the Hoechst AG

Reader Enquiry Service No. 362

APPOINTMENTS

TECHNICAL SERVICE CHEMIST JOHANNESBURG

AECI Paints is one of the leading paint companies in South Africa with associate companies all round the world. There is an excellent opportunity for a Technical Service Chemist to run the can coating and metal decorating section of the Johannesburg Research and Development Department.

Candidates must have a degree (or equivalent) and five years field experience in technical support to customers in the relevant technologies, including formulating and line trials.

The competitive salary will depend on the skills and experience of the successful candidate, and resettlement expenses will be paid.

If you are interested, please apply in writing to:

Miss J. E. A. Nuttall
 Personnel Officer
 ICI Paints Division
 Wexham Road
 Slough SL2 5DS
 Berkshire



SERVICES



SHELLACS NATURAL RESINS GUMS & WAXES

A. F. SUTER & CO. LTD.

Swan Wharf 60 Dace Road
 London E3 2NQ

Tel 01-986 8218 Gram Suterresin London E3
 Contact B. A. Slater

CONSULTANCY SERVICES

Consultancy offered

A well qualified materials protection consultant has a limited amount of time available. Experienced in formulation and testing of protective systems and also in inspection both in the UK and overseas.

Box Number 548

WANTED

DYESTUFFS WANTED

Wanted quantities of unadulterated, uncontaminated Orasol Navy Blue 2RB dyestuff.

Offers to: **Box No. 549**

MISCELLANEOUS

JOCCA Back Numbers

Member has for disposal copies of *JOCCA*.
 April 1954 onwards.

Offers to **Box No. 550**

JOCCA

READER ENQUIRY SERVICE MARCH 1985

Name

Job Title

Company

Address

Country

Telephone

For further information on adverts or editorials enter the Reader Enquiry Service Number/s in the boxes below:

This enquiry will be forwarded to the company/ies concerned.

JOCCA

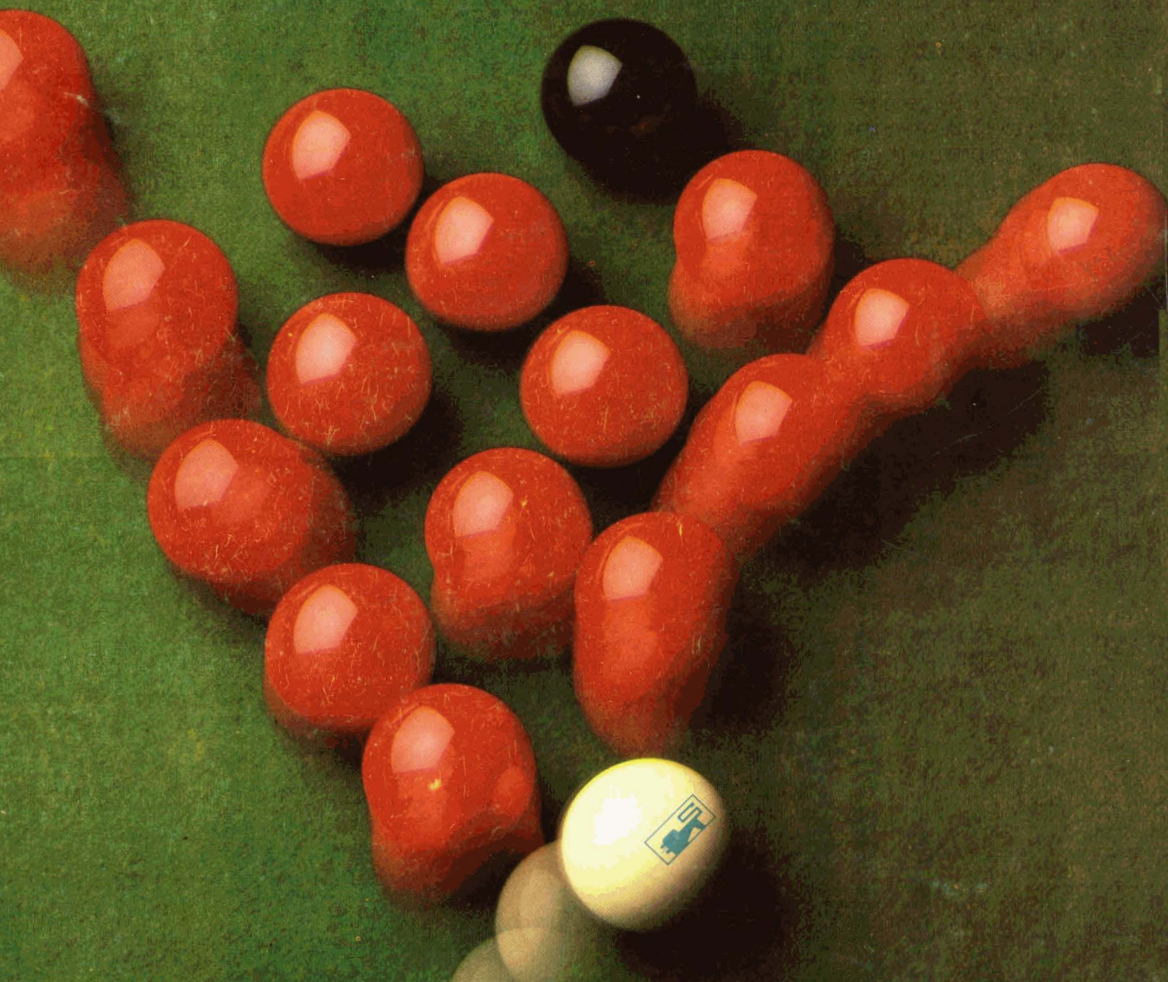
Priory House, 967 Harrow Road, Wembley,
 Middx., HA0 2SF, England
 Telephone: 01-908 1086 Telex: 922670 (OCCA G)
 Photocopy or cut out form and send to above address:

INDEX TO ADVERTISERS

Further information on any of the products advertised in this Journal may be obtained by completing the Reader Enquiry Service form. The Reader Enquiry Service numbers are shown in brackets below.

Chemische Werke Hüls AG	C	(355)	80-81
Graco UK Ltd	G	(369)	76
E. Hardman Son & Co. Ltd	H	(370)	ii
Manville (GB) Ltd	M	(219)	61
Minolta Camera GmbH		(312)	63
NL Chemicals (UK) Ltd	N	(367)	i
Riedel-De Haen AG	R	(362)	iv
Sachtleben Chemie GmbH	S	(364)	Cover
Sanyo-Kokusaku Pulp Co. Ltd		(283)	ii
Sub-Tropical Testing Service Inc.		(309)	77
Tambour Ltd	T	(372)	68

Blanc Fixe Micro.[®] Brilliant. And not just in its speed of dispersion.



The remarkable Blanc Fixe Micro, by Sachtleben, performs brilliantly to reduce costs and enhance the finished product.

This new micronised extender is unique in its speed and ease of dispersion. Excellent gloss values can be obtained at a low

binder requirement and at an average particle size of only 0.7 μ m. It augments titanium dioxide, and other pigments, without the slightest reduction in opacity, gloss or covering power. And its weathering ability has been tested to the limit under widely-differing conditions worldwide.

Use Blanc Fixe Micro to save time and energy in the manufacture of primers, stoving enamels, gloss paints, powder coatings, artists' colours and printing inks. Just contact us for today's best cover story.



»SACHTLEBEN«

UK Sales Offices: 56 High Street, Edenbridge, Kent TN8 5AJ.
Tel: (0732) 863694 Telex: 95297

38A Bury Old Road, Whitefield, Manchester M25 5TL. Tel: (061) 773 2000

Sachtleben products include Hombitan[®] TiO₂, Sachtolith[®], Lithopone, Blanc Fixe, Albaryt[®], and EWO[®] grades of Barytes.