ISSN 0030-1337 Vol. 66 No. 1 Pages 1-38 January 1983

Viking Hotel, York
Venue for the
1983 OCCA Conference
See pages 28-37 for
Summaries of papers
Plus
Biographies of authors

113

JOCCA

JOURNAL OF THE OIL & COLOUR CHEMISTS' ASSOCIATION

Nomination forms for elective Council members are enclosed to all members attached to the UK, Irish and General Overseas Sections

Novolac-based soya epoxy esters for surface coatings
D. Agrawal and A. K. Vasishtha

High build paints based on chlorinated rubber/coal tar pitch binders
J. J. Caprari, H. R. Pressa, B. del Amo and C. Lasquibar

Stability and flocculation in a latex paint. Part 2: flocculation in the drying paint film
M. J. Jaycock and G. J. Kayem

Refinishing over the next ten years
T. J. C. Tyler

Priory House, 967 Harrow Road, Wembley, Middlesex, HA0 2SF England

Reader Enquiry Service No. 108

Reader Enquiry Service No. 229

JOURNAL of the OIL AND COLOUR CHEMISTS' ASSOCIATION

Editorial corespondence 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: D. N. Buddles, BSc

Annual subscription to non-members: £50.00 ($110), post free by surface mail, payable in advance.

Single copies £5.00 ($12), post free by surface mail, payable in advance.

ABC Member of the Audit Bureau of Circulations

JOCCAB 66(1) 1-38 (1983)

Contents **Vol. 66 No. 1** **January 1983**

Directory of Secretaries ... 1

Novolac-based soya epoxy esters for surface coatings ... 2
D. Agrawal and A. K. Vasishtha

High build paints based on chlorinated rubber/coal tar pitch binders ... 6
J. J. Caprari, H. R. Pressa, B. del Amo and C. Lasquibar

Stability and flocculation in a latex paint. Part 2: flocculation in the drying paint film ... 11
M. J. Jaycock and G. J. Kayem

Refinishing over the next ten years ... 17
T. J. C. Tyler

Letters ... 20

Reviews ... 21

OCCA meetings ... 21

Company visits ... 22

News ... 24

OCCA Conference 1983 ... 28

OCCA news ... 37

Professional Grade ... 38

New members ... 38

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

Reader Enquiry Service No. 176

JOURNAL OF THE OIL AND COLOUR CHEMISTS' ASSOCIATION

VOLUME 66

1983

Published by

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

Directory of secretaries

Bristol
K. A. Chippington, ATSC, 37 Sheppard Way, Minchinhampton, Stroud, Gloucestershire GL6 9BZ

Hull
C. Goodall, LRSC, MIOP, AIWM, 53 Main Street, Swanland, North Humberside

Irish
P. N. Holmes, BSc, 19 Thormanby Lawns, Howth, County Dublin

London
A. J. Newbould, BSc, CChem, MRSC, 52 Park Road, Brentwood, Essex

Manchester
S. G. Heyes, BSc, c/o Mrs Linda Jenkins, BTP Tioxide International, Didsbury House, 748/754 Wilmslow Road, Didsbury, Manchester M20 0DW

Midlands
B. A. Fowler, 12 Broadoaks, Moss Pit, Stafford ST17 9DW

Trent Valley Branch
J. P. Bourne, BSc, AInstM, 5 Braybrook Close, Swanwick, Derbyshire DE55 1DS

Newcastle
S. Lynn, CChem, MRSC, 19 Waskerley Close, Sunniside, Newcastle upon Tyne NE16 5XX

Ontario
I. Sharples, Dominion Colour Co. Ltd, 199 New Toronto Street, Toronto, Ontario M8V 2E9

Scottish
R. F. Hill, CChem, MRSC, ATSC, Ciba-Geigy (UK) plc, Hawkhead Road, Paisley PA2 7BG

Eastern Branch
N. G. Baird, Craig & Rose, 172 Leith Walk, Edinburgh

Thames Valley
A. W. Fell, BSc, ATSC, LRSC, 4 Hadrians Gate, St Peter's Estate, Brackley, Northamptonshire

West Riding
T. Wood, BSc, MRSC, 26 Kingstonia Gardens, Ripon, Yorkshire

General Overseas Section

Nigerian Branch
N. K. Apatira, Ewekoro Works, PMB 21011, Ikeja, Lagos State

Zimbabwe Branch
J. C. Calasse, PO Box AY 60, Amby, Harare

New Zealand Division

Auckland
L. R. Smith, Hoechst New Zealand Ltd, PO Box 67, Auckland

Wellington
D. Holey, LRSC, MNZIC, Bayer New Zealand Ltd, PO Box 38-405, Petone

South African Division

Cape
Mrs C. J. de Villiers, PO Box 35, Paarden Eiland 7420

Eastern Cape Branch
A. D. Price, ICI South Africa, PO Box 3451, 54 Paterson Road, North End, Port Elizabeth 6000

Natal
T. E. Say, BSc, MRSC, CChem, PO Box 65, New Germany, 3620

Transvaal
E. R. Timm, MRSC, c/o SA Bureau of Standards, Private Bag X191, Pretoria, 0001

● ● ● ● ● ● ● ● ● ●

The list of Council members, committees of Council and section and branch committees for the 1982/3 session was given in full in the August 1982 issue of the Journal following the appointment of Council and the committees at the AGM held on 16 June 1982. For ease of reference the names and addrsses of the current Honorary Secretaries are shown above for both members and non-members wishing to contact any of the sections or branches.

Correction to list of Council committees on page 293 of the August 1982 issue: add Mr T. W. Wilkinson, AMCT, FTSC to the Professional Grade Committee.

Novolac-based soya epoxy esters for surface coatings

D. Agrawal and A. K. Vasishtha*

Department of Oil and Paint Technology, Harcourt Butler Technological Institute, Kanpur 208002, India

Summary

Epoxy esters were prepared by reacting soya bean oil fatty acids with epoxy resins which were prepared by the epoxidation of phenol-formaldehyde novolac resins. The epoxy esters were blended with alkyd resin and the film characteristics of these blends were studied at different pigmentation levels.

It was observed that the adhesion, flexibility, abrasion resistance and chemical resistance of the blends improved with increasing proportions of epoxy esters. The blistering tendency of the paint films and the rusting of mild steel panels can be reduced considerably by using these epoxy esters.

Introduction

Epoxy resins have been widely used in surface coatings on account of their good adhesion, flexibility, toughness, and superior chemical resistance. Vasishtha and Kaushal[1] observed that the epoxy resins based on phenol-formaldehyde novolac resins possessed improved film properties as compared with resins based on bisphenol-A. Starting materials such as the condensation products of o-cresol and formaldehyde, and bisphenol and n-butaldehyde have also been suggested in the literature[2,3].

Irrespective of the starting materials employed in their preparation, all the epoxy resins suffered from the inherent defect of water sensitivity because of the presence of hydroxyl groups. These groups, however, can be made to condense with long chain carboxylic acids, e.g. fatty acids, with the loss of water to form ester linkages. The prepared esters may be of various oil lengths with non-drying, semi-drying or drying characteristics, depending upon the type and amount of fatty acids used. Jaegar *et al.*[4] used phenol-formaldehyde novolac resins for the preparation of epoxy resins which were further esterified with drying oil fatty acids to yield epoxy esters. Further developments in the synthesis of these esters have been reported by Stoesser *et al.*[5] and Rinse[6].

The present work was conducted to study the film properties of novolac-based soya epoxy esters, and the effect of blending novolac epoxy esters with alkyd resin at different pigmentation levels.

Experimental

Materials used

Phenol

BDH LR grade phenol was used for the preparation of novolac resin.

Formaldehyde

BDH formalin solution (37.4 per cent w/v formaldehyde) was used for the preparation of novolac resin.

Epichlorohydrin

Danpha Chemicals LR grade epichlorohydrin was used for the preparation of epoxy resin from the novolac resin.

Soya fatty acids

These were prepared in the laboratory by splitting the soya bean oil.

Alkyd resin

Alkyd resin was prepared in the laboratory from soya bean oil by the usual monoglyceride process. The resin had an oil length of 56.5 and an acid value of 5.

Pigment

Rutile grade titanium dioxide pigment was used for the preparation of paint samples.

MTO

Commercial grade mineral turpentine oil was used for thinning the paint and varnish samples.

Driers

Cobalt naphthenate (6 per cent Co), manganese naphthenate (6 per cent Mn) and lead naphthenate (18 per cent Pb) driers were obtained as samples from M/s Technico Enterprises, Kanpur and a combination of these driers was used in the preparation of paints.

Preparation of novolac resin

Novolac resin was prepared in the laboratory by taking 100 parts by weight of phenol with an equal quantity of water in a three-necked flask. The pH was adjusted to 0.5 with sulphuric acid and the contents were heated to 80°C with constant stirring. Formalin solution (42.5 parts) was added drop by drop over a period of four hours while constant temperature was maintained. Heating was continued for an additional half hour after completion of the addition of formalin. The resin was washed with distilled water to remove acid and finally dried under vacuum. The resin had the following characteristics:

Degree of polymerisation (calc.)	3
Molecular weight (freezing point depression method)	300

*To whom all correspondence should be sent.

Body	viscous
Colour	reddish

Preparation of epoxy resin

One hundred parts of the novolac resin and 189 parts of epichlorohydrin were placed in a three-necked flask and refluxed at 110°C. Sodium hydroxide (27 parts as a 40 per cent aqueous solution) was gradually added over a period of three and a half hours. Heating was continued for an additional 15 minutes after which the contents were dissolved in toluene and the solution filtered to remove the salts. Toluene was then removed by heating under vacuum. The epoxy resin had the following characteristics:

Epoxide equivalent (pyridinium chloride method)	970
Hydroxyl equivalent (acetylation method)	165
Body	semi-solid
Colour	pale yellow

Preparation of epoxy ester

One hundred and sixty-five parts of the epoxy resin and 182 parts of soya fatty acids were placed in a three-necked flask and heated to 120-150°C until the contents became liquid. Stirring was then begun and the temperature was raised to 240°C. Heating was continued until the desired acid value was obtained. A blanket of nitrogen was maintained over the liquid throughout the heating period.

The prepared epoxy esters were of long oil length and had an acid value of 10.

Preparation of paints

Binders with different epoxy ester/alkyd blends were prepared according to the proportions given in Table 1. The blends were diluted to 50 per cent solids with mineral turpentine oil to produce vehicles for paint samples.

Table 1

Binder compositions

Binder code	Epoxy ester (pbw)	Alkyd resin (pbw)
A	100	
B	40	60
C	30	70
D	20	80
E		100

pbw = parts by weight

The paint samples were prepared by pigmenting the different vehicles with rutile titanium dioxide in laboratory pot mills at the levels shown in Table 2. Measured quantities of cobalt, manganese and lead driers were added. The paints were then thinned to brushable consistency with MTO.

Evaluation of film characteristics

The paints were applied on appropriate mild steel, tin and glass panels and allowed to dry. The testing was carried out according to methods suggested by the Indian Standards Institution[7].

Table 2

Composition of paints

Sample code	Vehicle (pbw)	Pigment (pbw)	Pigment/ binder weight ratio	PVC
A I	70	30	0.86	0.15
A II	60	40	1.33	0.22
A III	50	50	2.00	0.30
B I	70	30	0.86	0.15
B II	60	40	1.33	0.22
B III	50	50	2.00	0.30
C I	70	30	0.86	0.15
C II	60	40	1.33	0.22
C III	50	50	2.00	0.30
D I	70	30	0.86	0.15
D II	60	40	1.33	0.22
D III	50	50	2.00	0.30
E I	70	30	0.86	0.15
E II	60	40	1.33	0.22
E III	50	50	2.00	0.30

Results and discussion

Five binders consisting of epoxy ester and alkyd resin were prepared as shown in Table 1. The composition of paints prepared with these binders is shown in Table 2. The performance data of the paint films with respect to drying time, flexibility, scratch hardness and gloss are given in Table 3. The acid and alkali resistances of the paint films are represented on 0-5 scales in Table 4. The tendency of the paint films to blister and of the mild steel panels to rust on immersion in distilled water is shown in tables 5 and 6, respectively.

Drying time

The rate of drying of the epoxy ester-based coating was

Table 3

Drying time, flexibility, scratch hardness and gloss of paint films

Sample code	Drying time (minutes)		Gloss (% reflectance at 45°)	Flexibility ($\frac{1}{4}$ inch mandrel)	Scratch hardness (kg)
	Surface dry	Hard dry			
A I	45	390	49	passed	3.0
A II	40	385	46	passed	3.2
A III	40	390	35	passed	3.2
B I	50	405	45	passed	2.8
B II	50	380	40	passed	2.8
B III	50	410	34	passed	3.0
C I	55	410	46	passed	2.0
C II	60	410	40	passed	2.2
C III	55	420	35	passed	2.6
D I	70	460	40	passed	1.5
D II	75	470	34	passed	1.6
D III	70	470	32	passed	1.8
E I	80	490	50	passed	1.2
E II	80	480	46	passed	1.2
E III	75	500	43	passed	1.3

Table 4
Acid and alkali resistance of paint films*

Sample code	Condition of film after immersion (days)							
	Acid resistance with 30% sulphuric acid solution at 30°C					Alkali resistance with 2% soap solution at 70°C		
	2	8	15	20	30	2	7	14
A I	5	5	4	3	2	5	3	1
A II	5	5	4	3	2	5	3	1
A III	5	5	4	3	2	5	3	1
B I	5	4	3	3	1	4	2	0
B II	5	4	3	3	1	4	2	0
B III	5	4	3	2	1	4	2	0
C I	5	5	4	2	1	3	1	0
C II	5	5	4	2	1	3	1	0
C III	5	4	3	3	1	3	1	0
D I	5	4	3	2	1	2	1	0
D II	5	4	3	2	0	2	1	0
D III	5	4	3	2	1	2	1	0
E I	5	4	3	2	0	2	0	
E II	5	4	3	1	0	2	0	
E III	5	4	3	1	0	1	0	

*5 = film unaffected, 4 = slight change in colour and loss in gloss, 3 = change in colour or blistering of film, 2 = loss of adhesion and softening of film, 1 = partial removal of film from the panel, 0 = complete removal of film from the panel

Table 5
Blistering after immersion in distilled water at 30°C*

Sample code	Condition of film after immersion (days)					
	1	2	4	7	9	13
A I	5	4	3	2	2	1
A II	5	5	4	3	2	1
A III	5	5	4	3	2	1
B I	5	4	3	3	1	0
B II	5	4	4	3	2	1
B III	5	5	4	3	2	1
C I	4	4	2	2	1	0
C II	5	4	3	3	1	0
C III	5	5	4	3	2	1
D I	4	4	2	1	0	0
D II	5	4	2	2	1	0
D III	5	5	3	2	1	0
E I	3	3	2	1	0	0
E II	4	4	3	1	0	0
E III	4	4	3	2	1	0

*5 = film unaffected, 4 = fine blisters beginning, 3 = scattered fine blisters on the surface of the film, 2 = fine blisters all over the surface, 1 = medium sized blisters all over the surface, 0 = large blisters all over the surface

much faster compared with the alkyd-based coating. The drying characteristics of the alkyd improved significantly after blending with epoxy ester, the more the proportion of epoxy ester the shorter the drying time. No significant effect resulting from the level of pigmentation was observed with respect to drying time.

Gloss

The gloss of the paint films varied with the level of pigmentation. As the PVC of the films increased the gloss decreased. Nò appreciable differences in the gloss of films were noted between the epoxy ester and alkyd films or the films of the blends of these.

Flexibility

All of the coatings passed the flexibility test carried out on a quarter inch mandrel, which indicated the high flexibility typical of oil-based coatings.

Scratch hardness

The scratch hardness of epoxy ester films was highest,

Table 6
Rusting of substrate during immersion of painted panels in distilled water at 30°C*

Sample code	Condition of the substrate surface after immersion (days)				
	2	4	7	9	13
A I	5	5	4	3	3
A II	5	4	4	3	3
A III	5	4	3	2	2
B I	5	4	3	3	3
B II	5	4	3	3	3
B III	4	4	3	2	2
C I	5	4	3	3	3
C II	5	4	3	2	2
C III	5	4	2	2	2
D I	4	4	3	2	2
D II	4	4	2	2	1
D III	4	3	2	2	1
E I	4	3	3	2	1
E II	4	3	2	2	1
E III	4	2	2	1	1

*5 = film unaffected, 4 = slight under-rusting on the panel, 3 = under-rusting on the panel, 2 = under-rusting and pitting, 1 = severe rusting, 0 = total rusting of the panel

while that of the alkyd was the lowest. In between were the scratch hardnesses of their blends which decreased as the proportion of the epoxy ester decreased. The high scratch hardness of the epoxy ester films can be attributed to a relatively larger proportion of aromatic rings in the molecule of the novolac-based epoxy ester.

Increasing the PVC of the coatings resulted in slight increases in the scratch hardness of the films.

Acid resistance

The epoxy ester films showed comparatively better resistance to 30 per cent sulphuric acid solution than the alkyd resin films. The films of the blends of the two resins showed small but significant differences in acid resistance, with improvements in acid resistance with increasing proportions of epoxy ester. After 30 days of immersion, the epoxy ester films showed softening while the alkyd films were completely washed off. No significant differences in acid resistance however, were observed on account of degree of pigmentation.

Alkali resistance

The alkali resistance of the epoxy ester films was found to be far superior to that of the alkyd resin films; the differences became quite obvious during the first two days of immersion in a two per cent soap solution. The alkyd resin films were completely removed from the panels after seven days of immersion, while for the same period of immersion the epoxy ester films showed only some colour change and blistering. The alkali resistance significantly decreased as the epoxy content in the blends decreased. The degree of pigmentation seemed to have no effect on the alkali resistance of the films. This behaviour can be attributed to the presence of ether linkages in the backbone of the epoxy resins which remain unaffacted by alkali, unlike the ester linkages in the alkyd resins.

Water resistance

Two aspects of water resistance were examined using two sets of panels. In one set the blistering tendency of the films was examined, in the other set the rusting of the mild steel substrate was studied.

The blistering tendency of the epoxy ester films was far less than of the alkyd resin films. As the percentage of epoxy ester in the blends increased, the blistering tendency of their films decreased. The effect became very significant after seven days immersion in distilled water. The degree of pigmentation had a distinct effect on the blistering tendency of the films. The higher levels of pigmentation reduced the tendency of the films to blister. All of the films, however, showed a high degree of blistering after 13 days of water immersion.

The rusting tendency of the mild steel panels was also less for the epoxy ester films as compared with the alkyd films, which was mainly due to the higher water and oxygen permeabilities of alkyd films. Blending with epoxy ester significantly reduced the rusting tendency of the coated substrates. A blend of 30 per cent epoxy ester with 70 per cent alkyd produced a film offering a similar level of protection to those films of epoxy ester alone. The level of pigmentation seemed to have some effect on the protection afforded by the films. Films with lower levels of pigmentation provided better protection against rusting.

[Received 2 December 1981

References

1. Vasishtha, A. K. and Kaushal, V. K., *JOCCA*, 1979, **62**, 168.
2. Dynamit-Nobel, AG, Brit. patent, 969,221; see *Chem. Abstr.*, 1964, **61**, 13468a.
3. Lewis Berger and Sons Ltd, Brit. patent, 749,218; cf. *Paint Technology*, 1958, **22**, 272.
4. Jaegar, Y. E., Chemischer, F. and Rohstoffe, G., Ger. patent, 1,133,896; see *Chem. Abstr.*, 1963, **58**, 3579a.
5. Steosser, W. C., Sommerfield, E. H. and Surine, W. R., US patent, 2,875,165; see *Chem. Abstr.*, 1959, **53**, 9692a.
6. Rinse, J., US patent, 2,652,376; see *Chem. Abstr.*, 1954, **48**, 1028b.
7. *Indian Standards Institution*, IS: 101-1964 and IS: 157-1968.

High build paints based on chlorinated rubber/coal tar pitch binders

J. J. Caprari, H. R. Pressa, B. del Amo and C. Lasquibar

CIDEPINT, Research and Development Centre for Paint Technology (CIC-CONICET), 1900 La Plata, Argentina

Summary

Long life bituminous coatings were obtained using a blend of chlorinated rubber resin/coal tar pitch as a binder. A hydrocarbon resin was employed to make compatible the two components of the binder, and plasticisers were added to improve the adhesion and flexibility of the film. These paints could be marketed as a single pack – film formation takes place as a consequence of solvent evaporation. During re-coating, compatibility was not a problem as the coatings are non-convertible.

The variables studied were: surface preparation and pretreatment of steel plates, binder composition, the influence of additives, and the incorporation of pigments or extenders to improve the impermeability of the film.

Formulation was carefully studied, especially the order of incorporation of the different components – of fundamental importance in achieving a correct preparation.

Plates with and without primers were tested for 24 months on a raft in Mar del Plata's Harbour. Evaluation of the coatings was carried out firstly on the raft and after in the laboratory. A factorial statistical design $3 \times 2 \times 2 \times 2 \times 4$ was used to analyse the results, which allowed the study of five factors at different levels.

Introduction

Bituminous paints have been used for a long time for the protection of marine structures, especially where decoration is not important. This is so on the submerged part of hulls, in ballast tanks, on buoys and coastal area structures, etc.

The composition of bituminous coatings has remained the same over many years and these products still appear in several specifications such as those of the Steel Structures Painting Council,[1] the American Water Works Association,[2] the Ministry of Defence of the United Kingdom[3] and the British Iron and Steel Research Association.[4] Its components are bituminous substances (asphalts, bitumen, tar or pitches) and fillers (mica, asbestine, talc or silica). In some cases aluminium powder is added to improve water resistance and to reduce the water vapour permeability of the film.

The development of long life bituminous coatings is achieved by the incorporation of chemical resistant resins such as epoxies or polyurethanes, which improve film resistance. Two component products must be stored in separate packs (one for the resin and the other for the curing agent); they must be mixed in the correct proportion before application to obtain the maximum film resistance. After the blend is prepared, the pot life of the system depends on factors such as ambient conditions (temperature, humidity) and the nature of the curing agent.

After application there is a period during which the film attains the required properties. Later, during recoating operations, adhesion problems between the old and the new coat may appear. Paints must not be applied under humid conditions and it is known that temperatures below 5°C retard the curing processes.

In this work the use of binders based on blends of chlorinated rubber and coal tar pitch is outlined. These paints can be manufactured as single pack products, film formation occurring as a consequence of solvent evaporation.

During recoating, compatibility was not a problem as the coatings are non-convertible: the solvents of the new film partially dissolve the old one thereby improving intercoat adhesion.

These paints combine the chemical resistance characteristics of chlorinated rubber resin with the impermeability of coal tar pitch. The cost of the new coatings is lower than standard chlorinated rubber paints but higher than conventional bituminous formulations.

Variables that influence the behaviour of these paints were studied by means of performance tests (24 months raft exposure trials). The importance of metallic surface preparation and pretreatment to the anticorrosive properties of these paints was also studied.

Variables studied

1. Surface preparation and pretreatment

The application of bituminous paints directly on to bare sand blasted steel without primer is recommended by different authors. As these coatings work as barriers (inhibitive pigments are not employed) the suggestion is inadvisable because any damage to the paint film by impact, scraping, etc. will expose the unprotected steel and so corrosion will occur.[5]

In a previous paper concerning coal tar epoxy paints,[6] the authors established that a pretreatment based on a vinyl wash primer applied over the sand blasted steel improved the performance of the paint coating.

In this study also the influence of surface preparation was examined, employing sand blasted plates with and without vinyl wash primer or a zinc-rich primer based on a chlorinated rubber binder.

2. Binder composition

In these paints a quaternary binder composition was used (chlorinated rubber resin, plasticiser, coal tar pitch and a liquid 100 per cent aromatic coumarone resin).

The type of chlorinated rubber was selected according to the method of application of the paint (i.e. brush, roller, conventional spray or airless spray), and in relation to the properties required of the final product (i.e. gloss, gloss retention, weathering resistance and pack stability). In some cases it was necessary to employ a blend of two different grades of chlorinated rubber to obtain the desired properties.

In this series of tests, 10 cP chlorinated rubber was used. The paint prepared with this resin could be applied satisfactorily by airless spray, or by the other methods mentioned above with only slight modification in the composition of the solvent blend.

Plasticiser

Plasticisers are needed to improve the adhesion and flexibility of the film. They must be chemically resistant, have good migration resistance and adequate compatibility with the chlorinated rubber resins used. The preferred plasticisers were chlorinated paraffins with different grades of chlorination. If petroleum wax (hydrocarbon chain of 22-24 atoms of carbon) is employed, a product with a lower grade of chlorination (42 per cent) is used. If normal paraffins (14-17 atoms of carbon) are used the 52 per cent chlorine content resin is selected. Grades of shorter chain length are too volatile for this purpose.[7]

The two types of chlorinated paraffins mentioned above were studied comparatively in different paints.

Coal tar pitch type

The type of coal tar pitch is another important variable. The coal tar pitch must be compatible with the other binder components; it should not have reactive groups such as phenol, sulphur compounds or nitrogen containing bases, which reduce the useful life of paints during storage.

All coal tar pitches have variable quantities of substances insoluble in toluene, xylene or C_9 aromatic hydrocarbons, in some cases the proportion may exceed 20 per cent. These substances suspended in the pitch will separate if the paint is excessively thinned before application. As the products formulated are used for high build coats, these insoluble substances do not influence the final properties of the film.

Two coal tar pitches were used in this work, one domestic and the other one of foreign origin.

Hydrocarbon resin

The hydrocarbon resin employed to ensure compatibility of the two major components of the binder is of the aromatic coumarone type, with low softening point and high flash point.

3. Special additives

It is necessary to employ stabilising additives to ensure can stability even when a satisfactory pitch is used (free of chemically reactive groups), it is also necessary to add compounds which act as acid acceptors (e.g. some cycloaliphatic epoxy resins or zinc as zinc naphthenate, soluble in the solvent blend).

Thixotropic properties will depend on the gelling agent used. Film resistance and application method depend on the type of additives selected. A hydrogenated castor oil gel (15 per cent w/w) was used in this investigation, the thixotropic agent being added after grinding but before the preparation of samples was complete.

4. Pigments

Extenders or inert pigments were used to improve the level of impermeability, hardness and mechanical resistance of the film. Mixtures of red iron oxide/talc or red iron oxide/calcium carbonate were used in a 1:1 ratio (by volume) for the binary formulations. The same mixtures with the addition of barytes in a 1:1:1 ratio (by volume) were used for the ternary formulations.

Dispersion and grinding of the pigments were carried out in a Cowles disperser and in a sand mill, respectively. Viscosity was adjusted before the application of the paints.

Experimental

1. Preparation of samples

Thirty-two samples of bituminous paints were prepared using a chlorinated rubber/coal tar pitch binder and applied as high build coatings.

The composition of the binders are shown in Table 1. The main difference between the two binders is in the content of hydrocarbon resin.

The pigmentations employed are shown in Table 2. All samples had a pigment volume concentration (PVC) of 28.4 per cent and a solids volume concentration of 48.9 per cent.

As the products studied have a high solids content, the *order of incorporation* of the different components is of fundamental importance in achieving good performance. Firstly it is necessary to state that only a part of the solvent blend was employed initially. About 9 per cent was included with the bituminous material while 27 per cent was used in the preparation of the castor oil gel. The

Table 1

Composition of the vehicles (g/100 g)

Component	Vehicles	
	I	II
Binder:		
Chlorinated rubber 10 cP	16.5	14.3
Coal tar pitch	23.6	23.9
Plasticiser	5.9	6.0
Hydrocarbon resin	1.3	3.6
Stabilising agents:		
Zinc naphthenate (6%)	2.3	2.4
Epoxy resin	0.8	0.8
Gelling agent:		
Castor oil	2.3	2.4
Solvent Blend:		
Aromasol H	32.0	31.0
White spirit	15.3	15.6

Table 2

Composition of pigment mixtures (g/100 g)

Components	Pigment mixtures			
	A	B	C	D
Red iron oxide	75.8	41.0	77.5	41.9
Talc	24.2	26.0		
Calcium carbonate			22.5	24.4
Barytes		33.0		33.7

remaining 64 per cent was added in two parts: about half at the beginning of the dispersion and the rest to adjust the viscosity before the grinding operation.

In this way the performance of the equipment is optimal. Suspensions of high viscosity help the Cowles dispersion action, this is because it was designed to create a zone of very high turbulence at a short distance from the rotor, producing two important effects: the agglomerated particles are subjected to high shear which reduces them in size. These particles are then subjected to attrition, which reduces their size still further.

For binder preparation, chlorinated rubber resin (10 cP) was dissolved in the solvent blend incorporating the plasticiser and the hydrocarbon resin to obtain a liquid mass free of gelled particles. Afterwards, coal tar pitch and stabilisers are added.

Pigments were incorporated at low speed to facilitate wetting. The order of addition was dependent on their oil absorptions. This property is better referred to as binder absorption. When a pigment is incorporated into a binder, the particle surface is surrounded by the liquid. The quantity of binder necessary to encapsulate the whole particle depends fundamentally on the specific surface area of the pigment, the particle size, roughness of the surface, presence of pores and the final type of packing assumed by the pigment particles.[9]

The order of incorporation is firstly talc (maximum oil absorption) followed, in order of decreasing oil absorption, by red iron oxide, calcium carbonate and finally barytes. During the dispersion process the rotor reached the maximum speed and this condition was maintained for 10 minutes for a batch of 1200 g. If the pigments were added in order of increasing oil absorption, a high binder requirement would result at the end of the preparation. This would increase viscosity reducing the efficiency of the equipment.[10]

When this part of the preparation was completed, the dispersion rotor was changed to steel discs, grinding balls were then added. The viscosity of the final dispersion was adjusted to enhance the grinding efficiency.

Temperature was controlled by circulating water in the double wall of the container (35-40°C); the temperature reached 45°C when grinding was completed. The fineness was controlled by Hegman gauge. The castor oil gel was then added and after 5 minutes it was possible to obtain a good gel dispersion.

The product attained its final thixotropic properties after 24 hours storage.

2. Primers used, application method and film thickness

The formulations of the chlorinated rubber zinc rich primer, intermediate coat and antifouling paints are shown in Table 3. The vinyl wash primer used was according to MIL-P-15328, Form. 117 Specification.

Paint application was by brush, employing plates of sand blasted pickled low carbon content steel, 300 × 400 × 1.5 mm in size. System 1 includes one coat of chlorinated rubber zinc rich primer, two coats of chlorinated rubber/bituminous paint, one coat of intermediate paint and two coats of antifouling paint.

In system 2, the vinyl wash primer was used as the first coat. System 3 was prepared without anticorrosive primer.

Table 3

Composition of primer, intermediate and antifouling paints (g/100 g)

	Primer	Intermediate paint	Antifouling paint*
Binder:			
Chlorinated rubber 10 cP	20.0	18.2	
Chlorinated paraffin (42%)	11.1	10.1	
Phenolic varnish			3.9
Rosin WW			17.3
Pigments:			
Metallic pigment	18.6		
Extenders	1.0	20.3	6.8
Toxicants			48.4
Gelling agents:			
Castor oil	0.6	0.5	
Solvent blend:			
Xylene	24.3	25.4	11.8
Aromasol H	24.4	25.5	11.8
PVC (%)	24.1	16.4	29.8
Solids by volume (%)	34.7	30.5	52.3

*Fouling prevented for 24 months

The final average thicknesses obtained for the three systems were very similar: 380, 365 and 355 μm, respectively.

3. Evaluation of results

Steel plates were exposed on a raft in Mar del Plata's Harbour for 24 months; this period includes two seasons of intense fouling (spring, summer).

The final evaluation was made firstly on the raft by taking photographs of the plates. Later, a laboratory evaluation was made after the paint coats were removed with suitable solvents. The condition of the metallic surface was assessed using the 0 – 10 scale detailed in a previous paper[8] and mentioned in Table 4.

A factorial statistical design of 3 × 2 × 2 × 2 × 4 was used to analyse the results, which allowed the study of five factors at different levels.

Statistical analysis of the results obtained from the raft trials

Values corresponding to the degree of rusting of steel plates at the end of the immersion period are shown in Table 4. As mentioned above, these were the results of a visual comparison of the plates with reference being made to photographic records. Two well trained operators were used for this type of observation. The operators examined the steel plates without knowing which paint system corresponded to which panel. In this way judgement tendencies were reduced to a minimum.

With the data obtained using the factorial design, Table 5 was constructed showing the mean values of the main effect of each factor, within the studied level.

Each treatment was tested only once, and since it was thought, in accordance with prior knowledge, unlikely that three or more factors would interact, all the respective

Table 4

*Results of raft trials after 24 months – degree of rusting of exposed plates**

Binder	I								II							
Plasticiser	Chlorinated paraffin (52%)				Chlorinated paraffin (42%)				Chlorinated paraffin (52%)				Chlorinated paraffin (42%)			
Pigment	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Bitumen	Imported coal tar pitch (A) in all the samples															
Sand blasted plate	0	2	1	2	0	2	4	3	5	2	1	3	1	8	0	4
Sand blasted plate + wash primer	6	1	7	2	5	1	3	2	0	5	0	2	3	6	3	6
Sand blasted plate + zinc rich primer	6	8	10	8	8	10	10	10	9	5	10	10	10	10	3	8
Bitumen	Domestic coal tar pitch (B) in all the samples															
Sand blasted plate	0	4	8	8	1	2	0	4	1	4	0	1	0	2	3	9
Sand blasted plate + wash primer	0	0	1	7	1	3	9	6	3	4	0	0	2	4	1	1
Sand blasted plate + zinc rich primer	6	3	7	7	3	10	8	10	10	7	4	1	4	3	6	5

*Key 0 = plate completely rusted, 2 = very rusted, 4 = moderately rusted, 6 = little rust, 8 = very little rust, 10 = no rust

Table 5

Media of the main effects

Factor		Level: Variable	Level: Code No.	Mean value
A	Surface pretreatment	Sand blasted	a.1	2.75
		Sand blasted + wash primer	a.2	2.94
		Sand blasted + zinc rich primer	a.3	7.16
B	Type of coal tar pitch	A (imported)	b.1	4.75
		B (domestic)	b.2	3.81
C	Type of pigment	Red iron oxide/talc	c.1	3.50
		Red iron oxide/talc/barytes	c.2	4.42
		Red iron oxide/calcium carbonate	c.3	4.25
		Red iron oxide/calcium carbonate/ barytes	c.4	4.96
D	Type of plasticiser	Chlorinated paraffin (52%)	d.1	4.04
		Chlorinated paraffin (42%)	d.2	4.52
E	Resin used to ensure compatibility of the two major binder components	Minimum content (1.3%)	e.1	4.56
		Maximum content (3.6%)	e.2	4.00

interaction mean squares were combined to supply an estimate of error variance.

Applying the Fisher test, only the factor A (surface treatment) and the interaction CE (pigment type-hydrocarbon resin content) were significant at a 5 per cent level.

1. Main effects

Using Duncan's comparison method it was seen that factor A (surface pretreatment) was highly significant and that the other results were strongly influenced by it (Table 5). The best pretreatment was chlorinated rubber zinc rich primer (a.3); vinyl wash primer followed in order of merit (a.2) and in third place was sand blasted steel (a.1). The difference between the last two was not significant.

It was evident that the barrier effect of the paint system was not sufficient to provide total protection of the steel surface in the case of sand blasted plates or when vinyl wash primer was used. Chlorinated rubber zinc rich primer gave cathodic protection and increased the impermeability of the coat. Corrosion resistance was satisfactory with no blistering of the paint film.

Even when other effects were not significant from the anticorrosive point of view, some comments useful to formulators could be made.

The domestic and foreign coal tar pitch employed (factor B) behaved in a similar way and had similar chemical compositions. The infrared spectra (figures 1 and 2) of those samples are similar and made possible the detection of cyclic saturated hydrocarbons with different levels of substitution.

In the 1242 cm^{-1} wavelength zone both samples showed small peaks, possibly due to the presence of phenol or aryl or alkyl-aryl esters; these substances did not affect the storage stability of the final products.

The analysis of results for the pigment variations tested (factor C) indicated a slightly higher efficiency in the ternary pigmentations (c.2 and c.4), probably due to an increase in impermeability produced by the barytes.

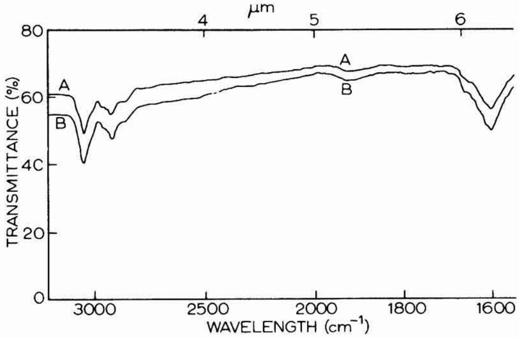


Figure 1. IR spectrogram of imported (A) and domestic (B) coal tar pitch: zone 3000-1600 cm^{-1}

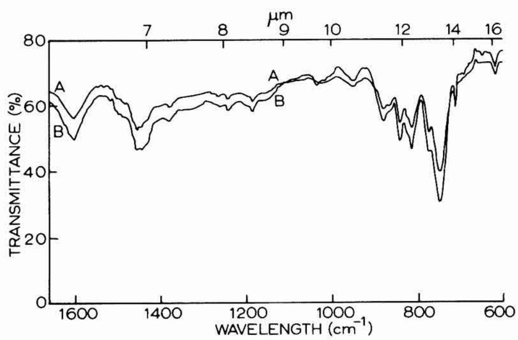


Figure 2. IR spectrogram of imported (A) and domestic (B) coal tar pitch: zone 1600-600 cm^{-1}

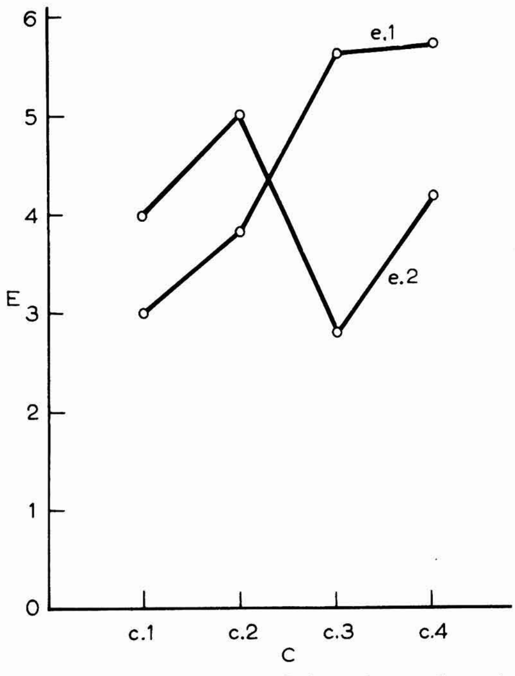


Figure 3. Interaction C-E, type of pigment-hydrocarbon resin (used to ensure compatibility) content

The behaviour of the plasticisers used (factor D) confirmed the possibility of replacing chlorinated paraffin 42 per cent (chlorinated petroleum wax) with chlorinated paraffin 52 per cent (chlorinated normal paraffin) for marine coatings. This replacement can be made weight for weight without affecting the chemical resistance of the system. This is interesting for countries where, due to petroleum supply problems, it is economical to use the last mentioned plasticiser.

The incorporation of hydrocarbon resin (factor E) to ensure the compatibility of coal tar pitch with chlorinated rubber resin did not influence the anticorrosive properties of the paints. As the hydrocarbon resin replaced chlorinated rubber, the real effect was to reduce the cost of the final product.

2. Study of interactions

The results obtained indicated that only the interaction CE (type of pigmentation-hydrocarbon resin content) was significant. Values are shown in Figure 3, where the levels c.4-e.1 and c.3-e.1 are significantly better than c.3-e.2 and c.1-e.1.

A high content of hydrocarbon resin decreased the chemical resistance of the film in sea water due to a reduction in chlorinated rubber in the formulation. The maximum content admissible is 3.6 per cent on the binder.

Conclusions

1. The use of chlorinated rubber resin 10 cP and coal tar pitch – made adequately compatible by means of a hydrocarbon resin – permitted the formulation of bituminous coatings with good sea water resistance and adequate storage stability.

2. The hydrocarbon resin content should not be higher than 3.6 per cent on the binder, otherwise sea water resistance diminishes.

3. The type of coal tar pitch used in this research did not have any influence on the results.

4. The plasticiser helped produce films with good adhesion and flexibility, and high mechanical and chemical resistance. Chlorinated paraffins containing 42 or 52 per cent chlorine may be used.

5. The performance of ternary pigmentations is superior to that of the binary ones. In both cases calcium carbonate performs better than talc. Barytes improved film impermeability.

6. The use of a chlorinated rubber zinc rich primer increased the anticorrosive performance of paint systems based on chlorinated rubber/bituminous paints.

Acknowledgement

The authors acknowledge the assistance of Lic. R. Pérez Duprat in the preparation and interpretation of IR spectrograms. They also thank the staff of the Mar del Plata's Naval Base for the support received during inspections of the experimental raft.

[Received 12 November 1981

References

1. Steel Structures Painting Council, "Steel Structures Painting Manual", vol. 2, "Systems and Specifications", 3rd. ed., *SSPC*, USA, 1967.

2. "AWWA Standard C-207-57", American Water Works Association, USA, 1957.
3. "Materials Specification 5954". Ministry of Defence, Ship Department, United Kingdom.
4. "BISRA Paints no174 and 655", British Iron and Steel Research Association, United Kingdom, 1950.
5. Steel Structures Painting Council, "Steel Structures Painting Manual", vol. 1, "Good Painting Practice", 6th. ed., *SSPC*, USA, 1973.
6. Caprari J. J., *et al.*, CIDEPINT-Anales, 223-245, 1979.
7. "Alloprene/tar high build paints. Alloprene Technical Bulletin ATB-2", Imperial Chemical Industries Limited, Mond Division, 1974.
8. Caprari J. J., *et al.*, Proc. 5th. Intern. Congress on Mar. Corrosion and Fouling, 1, 469, Barcelona, Spain, 1980.
9. Standard method of Test for Oil Absorption of Pigments by Spatula Rub-Out, D-281-31, "1969, Book of the ASTM Standards", part 20, ASTM, American Society for Testing Materials.
10. Payne, H. F., "Organic Coatings Technology 11", *Wiley*, NY, 1954.

Stability and flocculation in a latex paint. Part 2: flocculation in the drying paint film*

By M. J. Jaycock† and G. J. Kayem§

Chemistry Department, University of Technology, Loughborough, Leicestershire LE11 3TU, England.

Summary

The influence of dispersants on particle flocculation in a drying paint film is demonstrated by microscopic investigation of dried latex and paint films to be qualitatively predictable. This is shown from studies of the electrophoretic mobility of dispersions as a function of dispersant concentration.

From calculations based upon Derjaguin-Landau-Verwey-Overbeck theory it is demonstrated that latex solubilisation is essential for good pigment distribution in a dried latex paint film.

Introduction

This paper is directed principally at investigating some of the conclusions drawn from the studies in the previous paper[1].

The paint system investigated consisted of an alumina surface treated rutile pigment (AT-rutile) whose stabiliser was the polyphosphate, sodium hexametaphosphate (SHMP), and a polyvinyl acetate latex (PVAc) stabilised by sodium dodecylsulphate (SDS). The paint system was therefore essentially an electrostatically stabilised dispersion.

During drying in a charge stabilised paint system, the Derjaguin-Landau-Verwey-Overbeck (DLVO) theory predicts that as ionic strength increases, due to loss of water by evaporation, particle flocculation will occur. Two types of flocculation may be distinguished in latex paint dispersions. Homoflocculation involves particles of the same material and heteroflocculation involves particles which are different materials.

From the previous study[1] of the influence of the dispersants, SHMP and SDS, on the electrophoretic mobilities, U, of the AT-rutile pigment and the PVAc latex, it was deduced that SHMP improved pigment stability while reducing latex stability even to the point of flocculating the latex in certain circumstances. On the other hand SDS improved the stability of both the pigment and the latex, but could solubilise the latex, even in the presence of SHMP, if micelle formation occurred. In the light of these observations, the following tentative predictions can be made about flocculation in a drying latex or paint film:

(a) SHMP should encourage selective flocculation of latex and consequently poor film formation in the drying paint film.

(b) SDS should encourage good film formation by stabilising the pigment while dissolving the latex during drying.

(c) The quality of the film formed by the drying latex or paint should be significantly dependent on the ratio of SDS to SHMP in the original dispersion. The higher the ratio of SDS to SHMP the better the film should be.

The experimental investigations described in this paper should test the foregoing predictions. The DLVO theory will be applied to the drying process, as a first approximation, in order to explain the sequence of events.

Experimental

Reagents

All water used in the experiments was triple distilled. AR grade ammonium hydroxide was used to adjust the pH of the dispersions. In all cases the pH was adjusted to 8.0 ± 0.05, this pH having been chosen because most latex paints are made at a pH value between 7 and 9.

Materials

The specifications of the pigment, AT-rutile, the latex, PVAc, and the dispersants, SDS and SHMP, have already been stated in the previous paper[1]. The pigment was supplied in dry form while the latex was prepared in the laboratory and then exhaustively dialysed to remove the SDS used in the preparation. The particle sizes of the pigment and latex were found from transmission electron microscopy to be 0.25 ± 0.03 μm and 0.26 ± 0.02 μm respectively. The model system described is a glossy latex paint.

*Paper presented to the Newcastle Section on 8 January 1981
†To whom correspondence should be addressed
§Present address: Faculty of Science and Technology, University of Gezira, Wad Medani, Sudan

Experimental methods

The investigation of particle flocculation in a drying latex paint film is a very complicated process. Because of the difficulty in observing latex particles in the presence of pigment particles, the experimental approach adopted consisted essentially of preparing thin films by drying out latex or paint under controlled conditions. The thin films were then investigated by microscope methods, namely optical and scanning electron microscopy (SEM).

Preparation of latex and paint films

For the preparation of latex films, an amount of concentrated dialysed latex (40 per cent wt/wt) was diluted to 30 per cent wt/wt by adding water or dispersant solution while stirring gently. Some of the diluted latex (25 cm^3) was placed in a petri dish and a glass microscope slide was carefully immersed in the latex and allowed to sit on the bottom of the dish. The petri dish was then placed in a dust-free air-thermostated cabinet at $22.0 \pm 0.1\,°C$ (which was chosen to represent normal room temperature). After the latex had dried to a reasonably constant weight, the microscope slide carrying a thin latex film was cut out and the dry latex film peeled off for microscopic examination.

Paint film preparation was performed as follows. A concentrated dispersion of pigment (26 per cent wt/wt) was made by the addition of the pigment to water or dispersant solution (SHMP or SHMP and SDS) and then subjected to ultrasonic dispersion for ten minutes as described previously[1]. A PVAc latex containing SDS was also prepared, and by careful combination while stirring, an artificial paint of 20 per cent wt/wt solids was made at a polymer to pigment ratio of 1:5. Paint films were then cast in a similar manner to that described above for latex films.

The study of latex and paint films by microscopy

The dry latex and paint films were examined by optical and scanning electron microscopy. Photographs of representative sections were taken showing any changes in the film arising from the influence of dispersants on the latex. Only SEM photographs of the paint films were taken, whereas for the latex films, optical microscope photographs were taken as well. In the optical microscope studies on the latex films, the interiors of the films were photographed since the films were transparent.

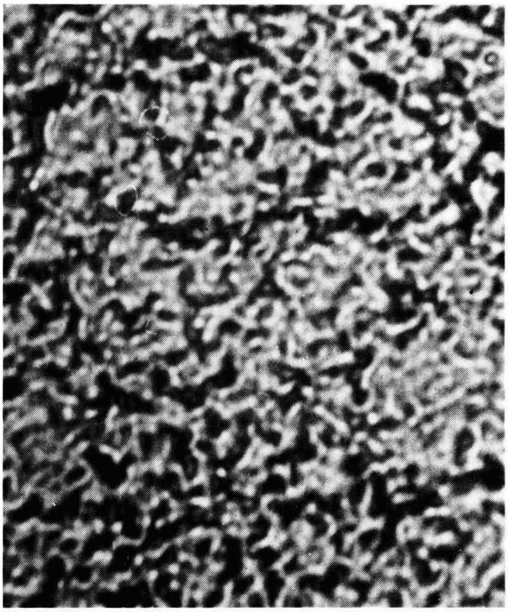
Results and discussions

In view of the fact that the latex component of a paint is responsible for film formation, flocculation and film formation by the experimental PVAc latex and paint will be considered separately in order to illustrate the influences of dispersants on the PVAc latex during drying.

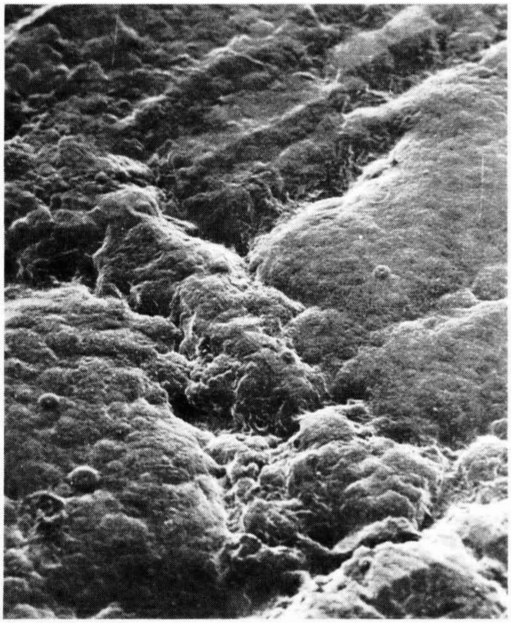
Effect of dispersants on the drying PVAc latex film

In the experimental section it was stated that the optical microscope photographs of the dry latex films were of the interior of those films. The purpose of this was to avoid making erroneous deductions based only on SEM photographs, which show only the surface structure, since exudation of dispersant onto the surface of the film may actually occur to such an extent that significant smoothing of the surface of the drying film may arise[2].

However, the interior of the latex film should not show any such effect.



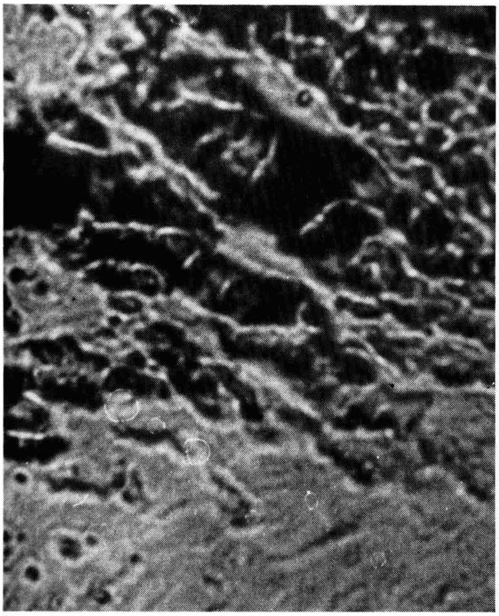
(a) optical micrograph, 1600×



(b) SEM, 1000×

Figure 1. Micrographs of dialysed PVAc latex

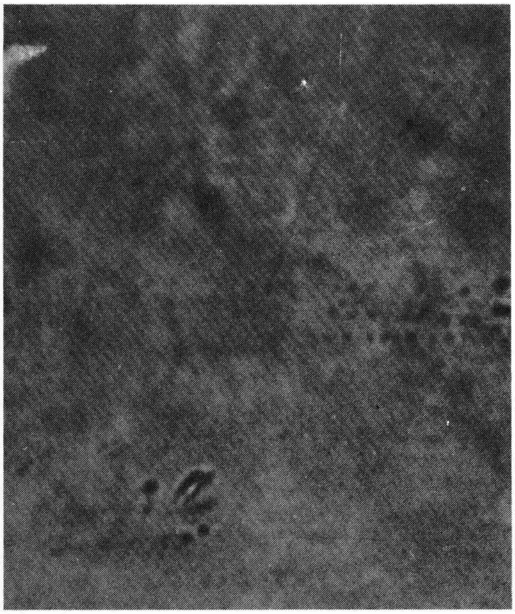
Figures 1a and 1b show the photographs of the interior and surface of a dry PVAc latex film containing no dispersants. The optical microscope picture, Figure 1a, clearly shows extensive structure in the film, probably indicative of the presence of flocs the distribution of which is fairly homogeneous. The SEM picture, Figure 1b, also indicates significant surface structure. Therefore, it suggests that a dispersant (SHMP) which encourages flocculation should increase the structure and give rise to



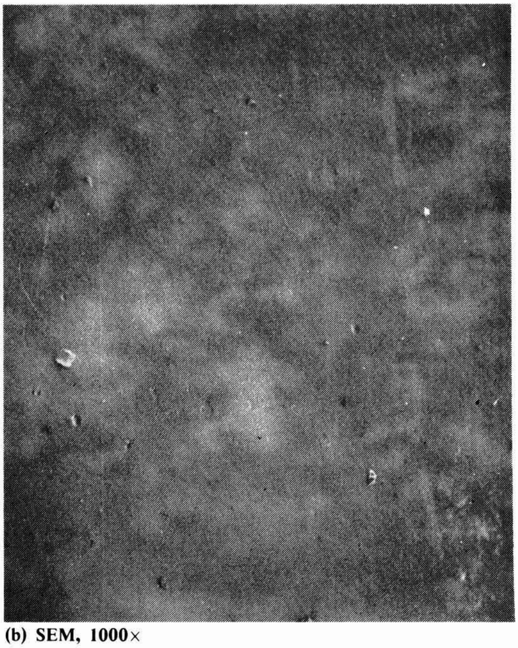
(a) optical micrograph, 1600×

(b) SEM, 1000×

Figure 2. Micrographs of dialysed PVAc latex in 5×10^{-5} mol dm^{-3} SHMP (0.25 per cent wt/wt)



(a) optical micrograph, 1600×



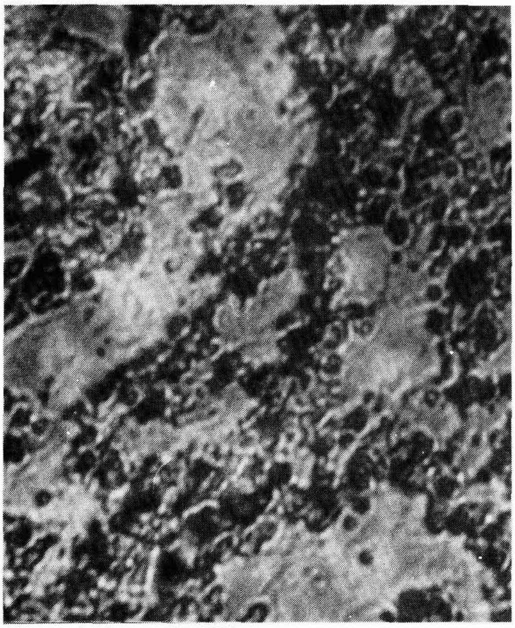
(b) SEM, 1000×

Figure 3. Micrographs of dialysed PVAc latex in 5×10^{-4} mol dm^{-3} SDS (0.4 per cent wt/wt)

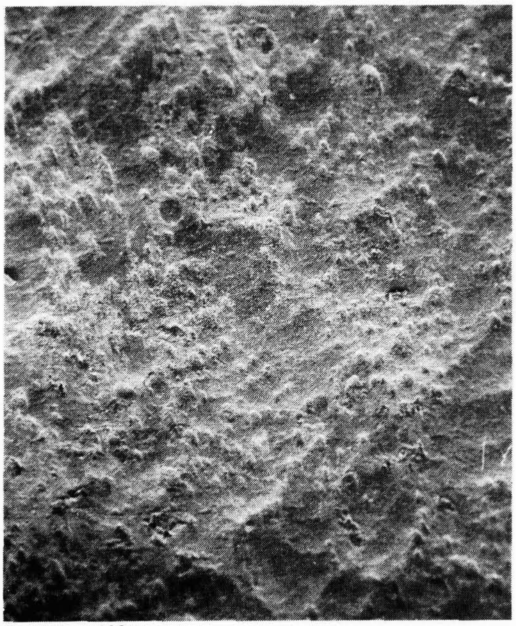
heterogeneous floc distribution in the latex film. A dispersant (SDS) which can solubilise the latex should decrease structure and give rise to a smooth film at high dispersant concentrations.

The foregoing predictions on the possible influence of SHMP and SDS can be confirmed by inspecting the photographs (figures 2 and 3) of films cast from latices containing dispersants.

By comparing the optical microscope pictures in Figure 2 to Figure 1a, it can be seen that the presence of SHMP causes increased heterogeneity in the latex film. Although it is not possible to comment unquestionably about changes in structure due to SHMP, it should nevertheless be noted that the dense areas in the optical microscope pictures in Figure 2 correspond to areas of large flocs in the film. In fact, film heterogeneity increased with increase in SHMP concentration in the original latex, thus



(a) optical micrograph, 1600×



(b) SEM, 1000×

Figure 4. Micrographs of dialysed PVAc latex in 1:1 mole ratio SDS/SHMP (5×10^{-5} mol dm^{-3} each)

confirming the prediction that SHMP should cause poor film formation.

In Figure 3, the presence of SDS leads to a decrease in structure and an improvement in the smoothness of the film which increases with the amount of SDS added to the original latex. Obviously the ability of SDS to solubilise the latex has a beneficial effect on film formation.

Figure 5. SEM of a paint film containing no dispersants, 1000×

Figure 4 shows the photographs of latex films containing mixtures of SHMP and SDS, where it can be seen that the undesirable influence of SHMP on film formation can be mitigated by the addition of SDS. Consequently, it seems reasonable to assume that the ratio of SDS to SHMP in a PVAc/AT-rutile paint should significantly influence the quality of the film formed by the paint.

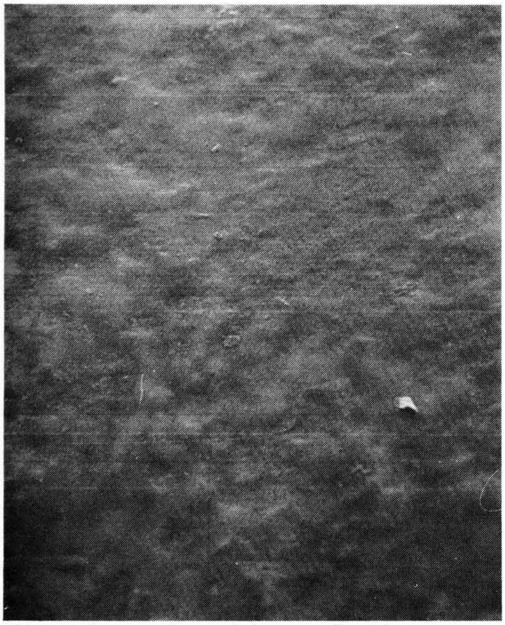
Effect of dispersants on film formation in the PVAc/AT-rutile paint

Of the paints prepared, one contained no dispersants whereas, in the rest, the concentration of SHMP was kept constant while varying the SDS concentration. The concentration of SHMP chosen, 5×10^{-5}mol dm^{-3}, corresponded to the maximum value of U for the pigment. Paint was not made with SHMP as the sole dispersant because instant precipitation occurred.

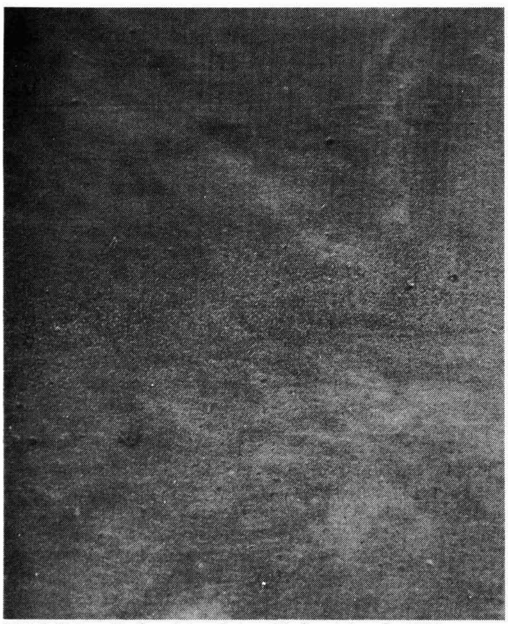
The photographs obtained from SEM studies of the paint films are shown in Figure 5 for the paint containing no dispersants and in Figure 6 for the paints with a variable SDS to SHMP ratio. A comparison of figures 5 and 6 indicates that the solubilising effect of SDS on PVAc has a considerable influence on the paint film formation. It leads to greater structured homogeneity and smoothness as the ratio of SDS to SHMP in the initial paint suspension increases. The trend to greater smoothness in Figure 6 confirms that the influence of the dispersants on latex film formation is carried through to paint film formation. Moreover, the observations noted in figures 1 to 6 clearly validate the predictions made in the introduction to this paper.

The DLVO theory applied to a drying emulsion paint film

The DLVO theory gives the total potential energy of interaction, V_T, between two colloid particles as the summation of the contributions from the attractive energy,



(a) 2:1 (10^{-4} mol dm^{-3}: 5×10^{-5} mol dm^{-3}), 1000×



(b) 5:1 (2.5×10^{-4} mol dm^{-3}: 5×10^{-5} mol dm^{-3}), 1000×

Figure 6. SEM of paint films containing various mole ratios of SDS/SHMP

V_A, due to Van der Waals forces, and the repulsive energy, V_R, from double layer interaction. A plot of V_T versus the separation distance, H, between two particles gives a curve such as is shown in Figure 7, where $V_{T(max)}$ is the maximum value of V_T and represents the energy barrier to be overcome before the particles flocculate into the primary minimum, which lies just to the left of the

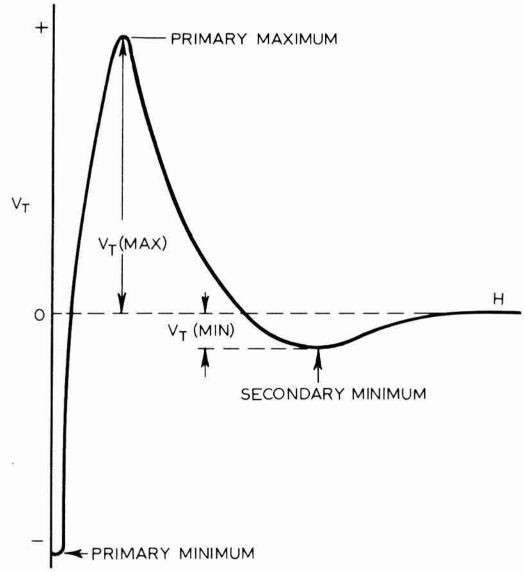


Figure 7. The total potential energy of interaction, V_T, of a pair of particles as a function of the distance of separation, H

maximum in Figure 7. $V_{T(min)}$ is the depth of secondary minimum, and its magnitude determines the probability of particles flocculating into the secondary minimum.

It was stated previously[1] that the DLVO theory gives the following approximate expression for the stability ratio, W, describing flocculation into the primary minimum:

$$W = 2R \int_0^{\infty} \frac{\exp(V_T/kT)}{(H+2R)^2}\, dH \qquad (1)$$

Where R is the particle radius, K Boltzmann's constant and T the absolute temperature.

According to Overbeek[3], Equation (1) can be replaced by the following approximate expression:

$$W = \frac{\exp(V_{T(max)}/kT)}{2\kappa R} \qquad (2)$$

Where κ is the Debye-Hückel reciprocal length. Fast flocculation occurs when $V_{T(max)}$ tends to zero and W tends to 1. As $V_{T(max)}$ increases, the tendency to flocculation decreases. Although the DLVO theory does not consider flocculation into the secondary minimum, Bagchi[4] has given a stability expression for this type of flocculation which shows that such flocculation is only significant when $V_{T(min)}$ is greater than 1kT, the rate of flocculation increasing with the magnitude of $V_{T(min)}$.

As a latex paint film dries out, the ionic strength of the film increases because of water evaporation. From the preceding considerations it can be deduced that a plot of $V_{T(max)}$ or $V_{T(min)}$ against ionic strength can be used to show flocculation tendencies during drying. The type of flocculation will be determined by the relative magnitudes of $V_{T(max)}$ and $V_{T(min)}$ for the interactions: latex-latex, latex-pigment and pigment-pigment.

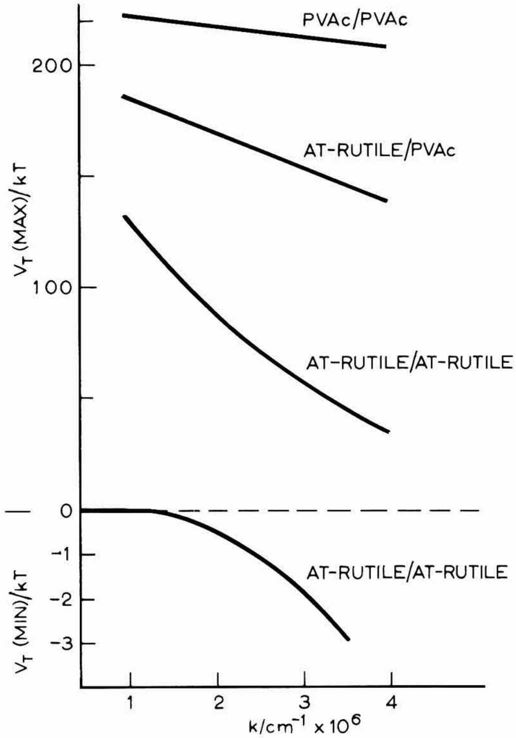


Figure 8. Values of $V_{T(max)}$ and $V_{T(min)}$ as a function of κ for the various particle interactions, ζ-potentials = −50 mV

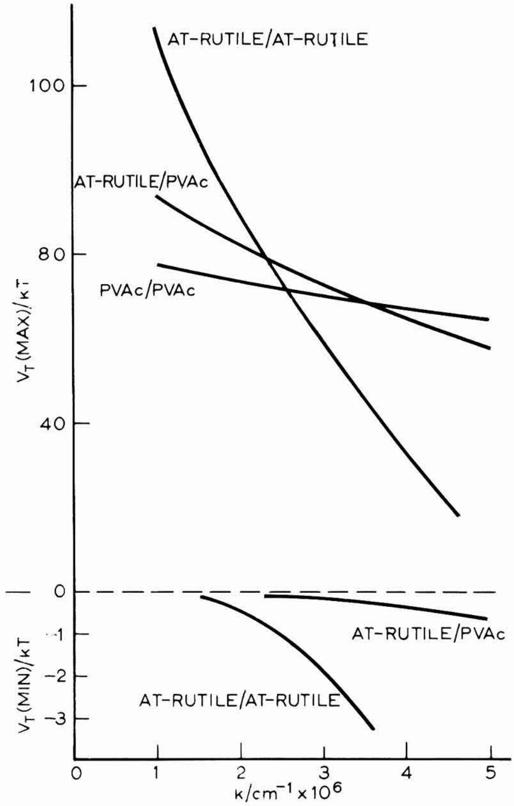


Figure 9. Similar calculations to Figure 8 with ζ-potentials of −50 mV on the AT-rutile and −30 mV on the PVAc

The electrophoretic mobilities of PVAc latex and AT-rutile pigment in the dispersant concentrations operative in a paint are shown in Part 1[1] as: −5.0 and −5.30 $m^2 s^{-1} v^{-1} \times 10^{-8}$ respectively. Hence the ζ-potentials of the latex and he pigment are comparable. By applying the Henry[5] equation, it was calculated that the ζ-potentials are more negative than −50 mV and probably of the order of −80 mV. The DLVO theory calculations are restricted to potentials not exceeding 50 mV. Therefore, we shall assume surface potentials of −50 mV and consider the variation of $V_{T(max)}$ and $V_{T(min)}$, with κ. The calculated curves for the different interactions are presented in Figure 8. It is evident that the tendency to flocculation decreases in the order pigment-pigment, latex-pigment, latex-latex. Figure 8 indicates that the pigment is the least stable particulate component in the paint, and its stability is far more sensitive to variations in ionic strength, since κ increases as the ionic strength increases. During drying, as the ionic strength increases, the pigment particles will settle into an ever deepening secondary minimum as evaporation takes place. Assuming the viscosity changes affect the pigment and latex particles similarly, the pigment particles will tend to homoflocculate in the secondary minimum before latex flocculation into the primary minimum occurs, so that eventually the pigment should be distributed as flocs in the dried paint film. Obviously such a trend of events will give rise to poor pigment distribution.

It may seem at first sight that the foregoing predictions of the DLVO theory are only valid for a pigment and latex having comparable ζ-potentials. That this is not so can be seen by inspecting Figure 9, where the latex potential has been lowered to −30 mV. Therefore DLVO theory calculations still predict preferential pigment homoflocculation during the drying of a charge stabilised paint film. In the absence of latex solubilisation the pigment will be distributed as flocs in the dried film. These theoretical predictions are reasonably well borne out by the observations on dried latex and paint films in the absence of SDS.

In latex and paint films containing significant amounts of SDS, better film formation occurs as a result of latex solubilisation when the critical micelle concentration (cmc) of SDS is exceeded during drying. It has been estimated that micelle formation and latex solubilisation take place when the pigment particles are already in the secondary minimum but are still about 15-30 nm apart. Latex solubilisation releases long macromolecular chains which increase the viscosity of the medium and also effectively prevent the pigment particles from approaching each other and entering the primary minimum. As a consequence of latex solubilisation, the pigment particles are trapped in a network of polymer chains and are kept apart, thereby being better distributed and producing better opacity. Hence it is clear that a charge stabilised latex paint will tend to produce a low gloss film upon drying, unless additives have been introduced in order to induce solubilisation during drying or to considerably retard pigment homoflocculation.

We have been unable to find any evidence of complete coalescence of flocculated latex particles in the absence of SDS. In this light it would seem that gums and thickeners probably act to inhibit pigment homoflocculation, while the addition of small amounts of organic solvent encourages latex coalescence during drying.

[Received 29 July 1982

Acknowledgements

We would like to thank BTP Tioxide Ltd for the financial support that enabled the work to be carried out, and Mr J. Clark, Dr L. Simpson and Mr R. Blakey for helpful and stimulating discussions.

References

1. Jaycock, M. J. and Kayem, G. J., *JOCCA*, 1982, **65**(12), 431.
2. Voyntskii, S. S., *J. Polymer Sci.*, 1958, **32,** 528.
3. Overbeek, J. Th. G. in Kruyt, H. R. (ed.), "Colloid Science" vol. one, *Elsevier*, 1952.
4. Bagchi, P., *Am. Chem. Soc., Symp. Ser.*, 1975, **9,** 145.
5. Henry, D. C., *Trans Faraday Soc.*, 1948, **44,** 1021.

Refinishing over the next ten years*

T. J. C. Tyler

Glasurit Beck Limited, Slinfold, Horsham, West Sussex RH13 7SH, England

Making predictions is one of those lovely subjects where only with hindsight can one be proved wrong.

I think it is fair to say that our market is a fairly slow changing one and generally speaking is fairly predictable over a three year period. In other words, the cars that are coming off the production lines today are the cars which will need refinishing over the next five or six years. Any significant changes within the next ten year period will be as a result of car design changes occurring in the latter half of the 1980s which will eventually earn our bread and butter by the year 1991.

There are a number of reasons for changes and I will define the principal points. I think it is reasonable to expect that most car manufacturers will be offering six-year guarantees covering the rusting of bodywork within the next five years, certainly within the next ten years. Within the next five years we will see oil prices rising still further as oil supplies become scarcer. North Sea oil will start to run out in about the mid-1990s and so the period from 1991 will see us with four years of North Sea oil left before the supplies start to run down. Obviously supplies will not be turned off overnight. There are several processes for producing petrol from coal, but that also means dearer petrol, as well as dearer solvents and dearer paints. By the mid-1980s, therefore, we shall have the advent of smaller cars with smaller engines, higher miles per gallon and probably fewer miles driven. The implications of the advances in the electronics industry in terms of microcomputers and small business systems will be mentioned and how these may well influence the repair trade in the latter half of the 1980s.

1. Worldwide oil prices have risen by 300 per cent over the last 18 months (May 1980-October 1981) from $12 to $36 a barrel. One can only forecast that as oil gets scarcer, fuel prices will continue to rise and probably by 1985 we will see petrol pump prices of £1.00 per litre at today's purchasing power. The predictions which were made between 1975 and 1978 on the eventual life of oil supplies did not reckon with the present worldwide economic recession. The OPEC countries have in fact dropped oil production from 28 million barrels per day to 20 million barrels per day and this will obviously stretch the oil resources a little longer. America has been the largest oil consumer in the world but is finding less oil each year than it is using. Saudi Arabia is the only exception to this trend and has found slightly more oil than it produces, but obviously this cannot go on. North Sea oil will start to run down by the mid 1990s and wells will eventually be running on second and third generation recovery systems to get the last dregs out of the ground.

By the end of 1991, which is the end of my ten year projection, petrol will start to become a luxury item, and certainly by 1995 one can reckon that the price of petrol will be associated with business account lunches. Probably by 1995, normal personal transport will be limited to battery operated vehicles with a range of about 60 miles.

Obviously the supply of fuel will not suddenly come to a halt overnight, other sources of fuel will be available and will become economically viable as world oil prices rise. There are very large deposits of tar sands and very large deposits of shale oils, but the cost of recovery of these will probably limit their use to the production of chemical feedstocks as they will be too expensive to be burnt.

Petrol from coal will be possible and this is the most likely source of fuel until new forms of energy are made available. South Africa is already producing approximately 50 per cent of her petrol by this process, but she has very thick seams of coal close to the surface.

That then is the rather depressing future for motor cars in this country. By 1985 cars will get smaller and certainly have smaller engines in order to get higher mileage per gallon. As petrol prices rise, the mileage driven will go down. Car manufacturers will also make cars as light as possible to get still more miles per gallon and this probably means the use of more and more plastics in cars in order to reduce weight. Due to fewer cars being on the road and less mileage being driven, the accident rate will probably drop and therefore there will be less accident repair work by the late 1980s.

2. Motor car manufacturers have already started giving long-term corrosion guarantees and it is to be expected that this trend will continue. It is reasonable to expect that by the mid 1980s most car manufacturers will be offering corrosion guarantees. It is also reasonable to expect, therefore, the increasing use of galvanised steel, aluminium and still more plastics in areas where high corrosion can be expected.

*Paper presented at the Thames Valley Section's "Vehicle refinishing" seminar held on 22 October 1981.

What does this mean to the paint manufacturers and the repair trade:

Galvanised steel is a difficult material to paint. So we should see wider use of two-pack epoxy primers, giving both good adhesion and good corrosion resistance on zinc and aluminium.

The present two-pack polyester formulations leave quite a lot to be desired if corrosion resistance is required to meet a six-year guarantee. These will be replaced by other two-pack systems, possibly epoxy or polyurethane, which will have both good corrosion resistance on steel and good adhesion to zinc and aluminium, but basically these will come in towards the latter half of the 1980s.

As has already been mentioned, plastics will be increasingly used in cars, both to reduce weight and to increase corrosion resistance, and more and more types of plastics are being introduced. It is believed that there will be no fundamently new plastic polymers introduced in the market for body components, but there will be more and more mixtures of plastics used for specific engineering areas.

The types of plastics which are being introduced into car manufacture will be examined along with the implications for the repair trade. It may well be asked why it is necessary to finish plastics at all, but the weathering characteristics of plastics are normally not as good as paints, and where a replacement plastic part abuts against an undamaged plastic part, there is usually a large colour difference. This applies to all plastics.

(a) Glass reinforced polyester (GRP) is already being widely used on specialised low-volume cars for bodywork and has been introduced as various parts in mass-production cars.

Glass reinforced polyester has a number of painting characteristics. It should not be heated to above 60°C otherwise the cavities are liable to swell and blisters will appear inside the GRP sheet. New unpainted parts normally still have a film of mould release agent on them which must be thoroughly removed. Not only will this material release the polyester from the mould, but it will also very effectively release the paint film from the surface. GRP is not sensitive to solvents and can be painted satisfactorily with the existing refinish enamels. The modern two-pack materials, epoxy and polyurethane, generally have better adhesion and better flexibility on high stress areas.

(b) Acrylonitrile-butadiene-styrene (ABS) is used principally in the spoiler area at the moment. The material is solvent sensitive and unless a proper sealing coat is used, the material will embrittle if normal paint is applied directly onto it.

(c) Polycarbonate is not widely used in mass car production. It is solvent sensitive but can be painted with a polyurethane paint by applying reasonably dry films. It should be pointed out that a polycarbonate crash helmet should never be repainted with car enamels unless the manufacturer states clearly that the paint is suitable for polycarbonate crash helmets, because under high impact conditions polycarbonate can shatter if it has been painted with the wrong kind of paint.

(d) Polyphenylene oxide (PPO) at the moment is principally used for interior parts in cars but may well find exterior applications in the future. PPO is a solvent sensitive material but can be repainted with two-pack polyurethane systems.

(e) Polypropylene modified polypropylene/ethylene-propylene-diene moulding compound (PP/EPDM) is increasingly being used externally on cars and is an extremely difficult material to repaint. It requires a special adhesion promoter and normal paints do not adhere well and rapidly chip off. Also, the material is flexible and normal top coats will crack. The most suitable materials are polyurethane systems with plasticising resin additions to give the necessary flexibility.

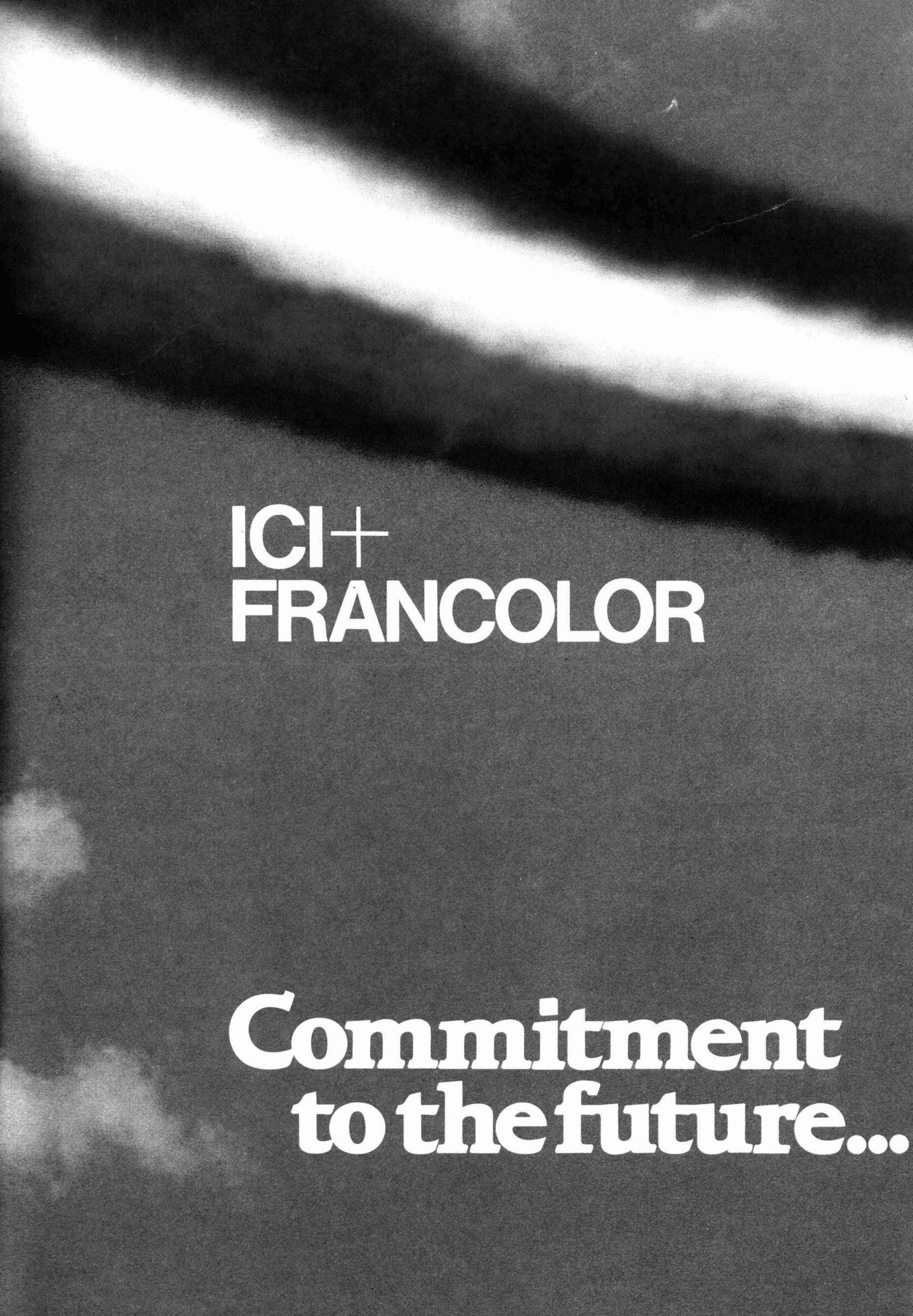
(f) Integral skin polyurethane foam is a very flexible material and is increasingly being used on the more expensive cars. It does require careful handling for successful painting. New parts as supplied must be cleaned to remove the mould release agent and only then can they be repainted directly with polyurethane top coat which again has been made more flexible by the addition of plasticising resins.

(g) Polyamide is not yet widely used but can be successfully repainted with polyurethane surfacers and the normal polyurethane top coats.

Over the next five to six years we can expect the introduction of one or two more new plastic types, but a wide range of blends of plastics for specific engineering purposes can also be expected, particularly of the thermoplastic injection moulded types. Each blend will have its own painting peculiarities and it is important that the trade should be aware of precisely what it is they are painting.

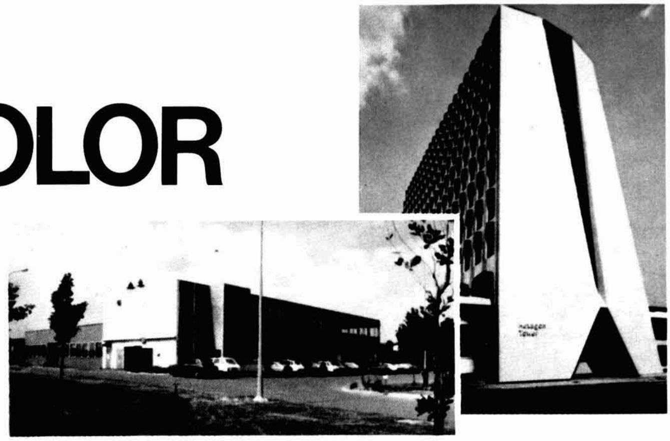
As a result of the requirements of long-term corrosion guarantees, it is certain that more two-pack primers will have to be used. This will result in requirements for better working conditions. In other words, all spraying will be carried out in spray booths and the use of breathing equipment will be the norm. It also means that to get a six-year warranty on repair work, a better repair and painting system will be required, and this means higher prices for repairs to meet these requirements. This in turn will be a matter of negotiation between the repair industry and the insurance companies.

3. Developments of cheaper microprocessors and cheaper small business computers, coupled with Prestel or the existing telephone system, will allow computer to computer communications between distributor and supplier to become commonplace, and possibly even to a "no paper office" system with automatic stock control, automatic re-ordering and automatic financial control, if required. The advances in electronics which have taken place in the last four or five years, coupled with the development of the Megabyte Chip, which is expected to be developed in the next couple of years, will result in very cheap and very powerful computer systems. The hardware has far outstripped the present software capabilities, but it is to be expected that some quite reasonable small business systems will be available with more flexibility than can be currently obtained. The information which is sent out at the moment on microfilm for use with colour mixing schemes could in future be sent out on floppy disc and displayed by VDU, or could be displayed through the customer's computer. This information could either be sent by post or directly down line from the supplier's computer to the customer's computer, either daily, twice weekly or once a week as required so that a continuous update of information is possible for the larger distributors. The present advances in microprocessors could eventually lead to fully automatic mixing schemes within the next ten years. The technology for this is



Reader Enquiry Service No. 225

ICI+ FRANCOLOR



Hexagon Tower, Blackley.
Hexagon Tower is the headquarters of ICI Organics Division's worldwide technical marketing operations.

FRANCOLOR's pigment applications laboratory at Villers St. Paul.

"A powerful platform for the future"

"The ICI acquisition of FRANCOLOR is one of the most exciting developments in our industry since *Procion* dyes were invented by ICI nearly 30 years ago.

That development was the biggest advance in dyestuffs technology of this century. Now, the joining together of the international colour business ICI + FRANCOLOR is the biggest step forward in our commercial and competitive position since that time, giving ICI a powerful platform for the successful and profitable development of a worldwide colours business.

Marketed through a single international selling organisation, the union will achieve a significant increase in sales volume while continuing to hold down product costs. Our jointly competitive edge will be sharpened, and our customers worldwide will benefit. At the same time, our broadened and more attractive range will help us to increase sales. Again, our customers will benefit directly from the improved service we now offer them. Today, and for the future, ICI Organics Division will be a powerful force to be reckoned with.

ICI is already a world leader in technology and research. Competitive, and with a total commitment to quality, reliability and service – now with a broader product range of approaching 2,000 dyes, textile leather and paper chemicals and pigments.

And with a strengthened promise for the future . . . for existing and new customers everywhere.

The complementary nature of ICI + FRANCOLOR products makes an ideal partnership – with a stronger, brighter and better future for our customers and ourselves worldwide."

A. T. G. Rodgers,
Chairman Designate
ICI Organics Division.

Broadening of Dyes & Pigments Manufacturing Profile

Dyes	**ICI**	**+ FRANCOLOR**
Reactive	■	
Disperse	■	
Acids – mainly for Wool		■
mainly for Nylon	■	
Directs	▪	■
Leather		■
Basics	■	■
Modified basics	■	■
Premetallised		■
Sulphur		■
Vats	■	■
Indigo	■	
Solvent	■	■
Pigments		
Phthalocyanine blues	▪	■
Phthalocyanine greens	■	
Azo	▪	■
Toners		■
Vat	■	
Inorganic	■	

OD210

The words *Procion, Dispersol, Nylomine, Neutrichrome, Solanthrene, Monastral, Monolite, Lutetia, Vynamon, Polymon, Waxoline* and *Thermoplaste* are trademarks.

ICI Organics Division

FRANCOLOR

Head Office: Imperial Chemical Industries PLC.
Organics Division, Hexagon House,
Blackley, Manchester, England.

Branches and Agencies throughout the world. Service to customers in more than 80 countries.

already available, it is largely a question of personnel training. So for the distributor, continuous training will be required in newer techniques in order to keep up-to-date. This refers not only to paint suppliers, but also to spare parts and component suppliers.

4. As oil prices rise in the late 1980s, so will thinner prices and paint prices. In order to keep prices down, there will be more pressure on the paint manufacturers to reduce the solvent content of paints, either by using water-borne paints or high solids paints or solvent free coatings, the latter two types certainly being two-pack materials. Universal use of water-borne top coats of the present technology is difficult in the car repair market because of the very varied conditions in which paints are expected to be dried. Water-borne top coats normally require not only temperature control but also humidity control, and this puts them out of court as far as the repair trade goes. Water-borne surfacers and primers will certainly be possible, but they need warmth to dry in our climate and again there is a need for low-bake facilities on whole resprays or lamps for use on spot repairs. With higher prices for paints, the transfer efficiency will have to be improved and I would expect by the late 1980s to see the widespread use of electrostatic spray equipment, particularly for primers and surfacers, in the larger installation.

With motor manufacturers increasingly using the "world car" concept, in other words fewer body shells in larger numbers, we may well see the advent of specialist repairers dealing with only two or three types of body shell, with a consequent reduction in costs. Certainly the trade will see great changes in the latter half of the 1980s. There will obviously still be a market in older cars for the two-man business, but the emphasis will certainly be on higher technology products. The message is clearly more products, not less, higher technology products, not simpler products, more computers, and for the trade this means more regular updating.

To sum up then –

World petrol prices will rise as oil gets scarcer throughout the 1980s. Cars will become smaller and the mileage driven will go down when fuel becomes a luxury.

Higher corrosion resistance paints will be required with a new generation of primers for zinc and aluminium. A greater use of plastics will require more types of plastics mixtures.

As solvent and paint prices rise, high solids, solvent free and water-borne paints will become increasingly important.

Many of these paints will be two-pack and will require better air extraction and drying facilities.

Intercomputer communication will be common and if the software can keep up with the developments in hardware, this system will be practical for distributors.

Mixing schemes run by floppy disc rather than micro fiche will be possible.

Continuous personnel training will be needed.

The message is clear. More paint products, higher technology products, more computers and by 1991 a shrinking market.

[Received 19 November 1981

next month's issue

The Honorary Editor has accepted the following papers for publication. They are expected to appear in the February issue:

An alternative method for testing the mould resistance of paint films *by A. F. Bravery, S. Barry and W. Worley*

The use of DTA to study the UV curing of acrylic resins *by T. R. Manley and G. Scurr*

AC impedance measurements on thick organic coatings on mild steel substrates *by S. Narain, N. Bonanos and M. G. Hocking*

Flakeglas-filled coatings: past, present and future *by N. Sprecher*

letters

Letters to the Hon. Editor should be sent to the Association's offices, see contents page for address.

The neglect of dispersion

It was great to see Dr Carr in print again (Dispersion – Oct 1982)! Why is this parameter neglected? One reason could be that we are still under the influence of classical colloid chemistry dealing with infinitely dilute suspensions! This enables us to be quite at home with one particle per field while the presence of two particles would give rise for concern. Three particles would throw us into panic!

More seriously is the fact that milling and dispersing were regarded as infra dig compared with other operations, unless reported by the upper echelons of academics (e.g. Dr Carr) or their associates. OCCA is quite guilty in this respect. I thought that a lecture I gave in Bristol in the early sixties merited publication in *JOCCA* but was informed that "this was not the type of paper required". I avoided any odious comparison with some papers published because I was mollified by a generous fee for the publication of the lecture in *Paint Manufacture*. Nevertheless the unnecessary barrier between formulation and manufacturing procedures created "U" and non-"U" personnel, a situation unsatisfactory for the industry and almost disastrous for specific companies.

I am not in full agreement with Dr Carr on some of the topics. Imagination has to be exercised in many respects. For example, the smaller the particle size the greater the stability – yes I agree whole heartedly! However will there be a true stability at the collodial state? Brownian movement in a highly concentrated complex system may still provide the means of inter-particulate aggregation by collision and hence eventual flocculation. However I will not write a paper on it (even if I had concrete evidence) for it probably wouldn't be published!

22 Gladstone Court
Anson Road
Cricklewood
London NW2 4LA

Yours faithfully,
I. Berg

9 November 1982

I would like to thank Mr Berg for his kind remarks about my paper in the October issue ("Dispersion – the neglected parameter") and I note that he, as a very practical man, agrees with me that dispersion is indeed a neglected parameter.

It is quite true that classical colloid chemists cannot, as yet, deal theoretically with the high concentration of small particles found in paints and inks, but at least they have tried to do so.

Their failure, to my mind, does not excuse the surface coatings industries from failing to measure and monitor dispersion in a rational way and investigate its effect empirically. My paper was intended to show the light that such measurements might throw on a variety of problems.

31 Lindow Fold Drive
Wilmslow
Cheshire SK9 6DT

Yours faithfully,
W. Carr, PhD, FTSC
21 November 1982

A dosimeter for ultraviolet radiation

It has been shown that polysulphone film is sensitive only to wavelengths below about 320 nm[1]. This feature of polysulphone film is the basis of a simple method of measuring ultraviolet radiation (UVR).

On exposure to a source of UVR, such as the sun or the lamp of an artificial weathering chamber, the UV absorption of the film increases and this increase, in particular the change in optical density at 330 nm (ΔA_{330}) as measured on a conventional UV spectrometer, gives a measure of the incident radiation dose.

The ΔA_{330} resulting from the exposure of polysulphone film to a UV source can be expressed in terms of an equivalent dose of 305 nm monochromatic radiation necessary to produce the same ΔA_{330}.

Because of the similarity between the erythema action spectrum for human skin and the spectral response of polysulphone the film has been used in medical studies as a personal UVR dosimeter, for example to quantify the natural UVR exposure of groups of people in different environments[3-6].

Polysulphone film has been used to measure the UVR environment outdoors; comprehensive data on the UVR levels throughout the year have been obtained for a temperate and tropical site using the technique[7]. The inertness of polysulphone film has also enabled the UVR penetration of sea water to be measured *in situ*[8].

Of particular interest to *JOCCA* readers is the recent application of polysulphone film to measure the UVR output of lamps used in artificial weathering chambers[9].

Further details and supplies of polysulphone film can be obtained from the address below.

References

1. Davis, A., Deane, G. H. W. and Diffey, B. L., "Possible dosimeter for ultraviolet radiation", *Nature*, 1976, **261**, 169.
2. Challoner, A. V., Corless, D., Davis, A., Deane, G. H. W., Diffey, B. L., Gupta, S. P. and Magnus, I. A., "Personnel monitor of exposure to ultraviolet radiation", *Clin. and Exp. Derm.*, 1976, **1**, 175.
3. Leach, J. F., McLeod, V. E., Pingstone, A. R., Davis, A. and Deane, G. H. W. "Measurement of the ultraviolet doses received by office workers", *Clin. and Exp. Derm.*, 1978, **3**, 77.
4. Corbett, M. F., Davis, A. and Magnus, I. A., "Personnel radiation dosimetry in drug photosensitivity: field study of patients on phenothiazine therapy", *Brit. J. Dermat.*, 1978, **98**, 39.
5. Diffey, B. L. and Davis, A., "The Anatomical distribution of sunlight", *Brit. J. Dermat.*, 1977, **97**, 407.
6. Diffey, B. L., Tate, T. J. and Davis, A., "Solar dosimetry of the face: the relationship of natural ultraviolet radiation exposure to basal cell carcinoma localisation", *Phys. Med. Biol.*, 1979, **24**, 931.
7. Davis, A., Howes, B. V., Ledbury, K. J. and Pearce, P. J., "Measurement of solar ultraviolet radiation at a temperate and a tropical site using polysulphone film", *J. Pol. Degn. and Stab.*, 1979, **1**, 121.
8. Davis, A., "The Weathering of Polymers", chapter 9, "Development in Polymer Degradation", *Applied Science Publishers*, 1977.

9. Davis, A. and Gardiner, D., "An ultraviolet radiation monitor for artificial weathering devices", *J. Pol. Degn. and Stab.*, 1982, **4**, 145.

3 Cumley Road
Toothil
Ongar
Essex CM5 9SJ

Yours faithfully,
A. Davis, ARCST, PhD, DSc

11 October 1982

letters

Further information from the publishers of the titles reviewed can be obtained by completing the *Reader Enquiry Service* form at the back of the *Journal*.

reviews

Developments in polymer photochemistry – 3

N. S. Allen, editor
Applied Science Publishers Ltd, London and New Jersey, 1982
pp. X + 353
Price £40

This volume contains eight well-documented review articles on polymer photochemistry, written by individual specialists. These cover photoinitiated polymerisation, photocrosslinking of polymers, photoconduction, polarised photoselection techniques, photodegeneration and stabilisation of polyvinyl and polyurethanes, laser flash photolysis of polymers, and commercial aspects of polymer photostabilisation. Although the UV-curing of surface coatings is developing more slowly than some anticipated, several of these chapters are of direct interest to the coatings industry. The chapters on degradation and stabilisation are primarily concerned with plastics but the general principles apply in the coatings field.

Reader Enquiry Service No. 21 *L. A. O'Neill*

Information regarding membership of OCCA is obtainable from the Association's offices, see contents page for address.

occa meetings

Manchester

DISC – a discourse in surface coatings

The Manchester Section of OCCA sought to repeat the success of the novel form of one-day meetings – "The whys and wherefores of corrosion" held in 1979 – on Friday 24 September 1982 at Lancaster University. They succeeded.

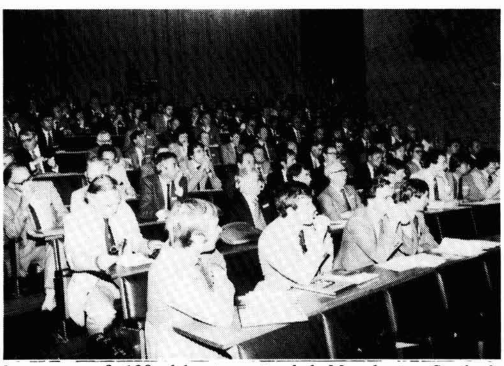
In excess of 130 delegates attended, there were 13 display stands (including OCCA's) manned all day, and this successful discourse was preceded by an excellent dinner on the night of 23 September, held in the University's Grange private dining room.

Breakfast was followed by registration at 9.00 a.m. in the Chemistry Colloquium Room before the official welcome and opening of the discourse by Frank Redman, Chairman of the Manchester Section, in the Physics Lecture Theatre at 9.30 a.m.

Frank's contribution was followed by that of Eric Hurst, the Section Hon. Technical Liaison Officer and prime organiser of the discourse. Eric dealt with the logistics and organisation – essential details included locations of lecture venues, bars and dining rooms.

Leslie Silver, a very well-known figure in the paint industry, was the chairman of the morning session, dealing with equipment and dispersion. He was ably assisted by discourse leaders Bill Black of ICI Ltd Organics Division and Howard Sullivan of D H Industries.

In the Colloquium Room, Professor John Bevington of Lancaster University was the chairman of the session dealing with resins and vehicles. The two discourse leaders assisting John Bevington were Geoff Topham of Goodlass Wall and W. J. P. Baily of Vinyl Products.



In excess of 130 delegates attended Manchester Section's "DISC" discourse

An excellent lunch was provided before the afternoon discourse on pigments and additives commenced under the chairmanship of Jack Mitchell of Crown Paints. Jack's discourse leaders were Geoff Flood of Ciba-Geigy Pigments, Paisley and John Rackham of BTP Tioxide. Concurrent to this session was a discourse session entitled "Environmental constraints" chaired by Michael Levete of

occa meetings

the Paintmakers Association. Discourse leaders supporting Michael were David Clayton of Crown Paints and D. J. Reynolds of Berger Jenson Nicholson.

Finally, Frank Redman made his closing remarks to the discourse delegates in the Physics Lecture Theatre, giving special thanks to Eric Hurst, John Calderwood, David Tench and the Discourse Technical Sub-Committee, John Ebdon and Lancaster University, the chairmen from industry, and the delegates for their support; and that concluded a successful Discourse in Surface Coatings.

F. B. Windsor

Midlands

Coatings for plastics

The second technical lecture of the session was held on Thursday 21 October 1982 at the Clarendon Suite, Stirling Road, Edgbaston, Birmingham.

Members and guests heard Mr D. Lewis of Sonneborn and Rieck Limited give a talk on "Coatings for plastics".

Mr Lewis said that many trade coaters who want to paint plastics have little knowledge of its type or composition or its method of fabrication. To formulate a successful coating the paint chemist must know the following three things:

1. The type and composition of the plastic.
2. The moulding conditions and release agents used.
3. The performance and durability specifications.

Various coating systems can be used depending on the plastic. These include polyurethane and epoxies which can cure at room temperature or at 60-80°C, acrylics, vinyls and alkyds. These coatings can give excellent surface hardness and scratch resistance that the plastic does not have. The choice of system will depend on the particular plastic and the service-life expected from the coating.

The speaker then went on to describe a typical finishing process. The first stage in any coating process is the cleaning of the substrate. This is necessary to remove moulding grease and other debris from the surface. Next a primer and/or primer filler may be applied to cover up surface defects in the moulding. After light flatting a final coat of finishing paint is applied. This can be either smooth or textured, gloss or matt.

Throughout his talk Mr Lewis showed numerous slides illustrating the uses of plastics, the types of plastics used and some of the surface defects on the mouldings which the paint chemist has to overcome.

To conclude his talk the speaker briefly outlined some of the defects he had encountered on coated plastics, what had caused them and how they could be overcome.

A lively question time following Mr Lewis' talk and the meeting finally closed with a vote of thanks proposed by Mr E. Wallace which was warmly endorsed by the audience.

B. E. Myatt

company visits

International Paint launches Spraystore and Autofact

International Paint launched what is describes as "two unique concepts that will make a major impact on refinish paint distribution in the UK", namely Spraystore and Autofact.

Spraystore is a franchised operation for factoring refinish paints. Autofact is a comprehensive software system that eliminates the majority of the paperwork involved in refinishing paint distribution which is unproductive and time consuming.

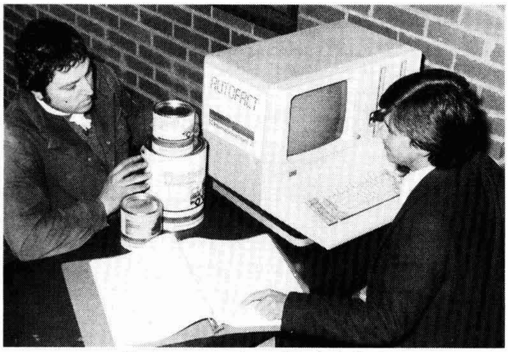
The company, International Paint, provides the image, standards, method of operation, business systems, training and marketing support.

Further information on all companies visited is obtainable by completing the *Reader Enquiry Service* form at the back of the *Journal*.

It is expected that most interest will come from those who know the refinishing trade, and the company will provide the necessary business experience to get those involved started with the best possible chance of making a real success of the operation.

International have been operating a Spraystore in Redditch, Worcestershire for some time under normal market conditions using the expertise of International's marketing department. Valuable experience has been gained from this activity and the company is confident of its success.

International's first Spraystore which is sited in Redditch. It has been operating for some time yielding "valuable information"



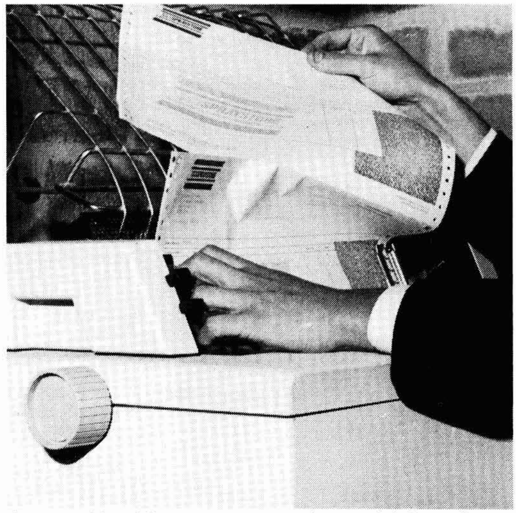
Customer service with Autofact

Most businesses have greatest difficulty with accountancy, cash flow, and stock control. The Autofact system, comprising a computer, readout and printout, is based on the IBM System 23, which is leased, the software being provided by International. With standard programmes the factor can obtain instant recall on stocks and current cash status, and with a connection to a terminal at Ladywood, details of formulations and other data can be instantly obtained.

It will be interesting to see how well this franchise succeeds in view of the downturn in the refinishing market over the past few months.

For its novelty alone the system deserves success.

Reader Enquiry Service No. 25 — *D. S. Newton*

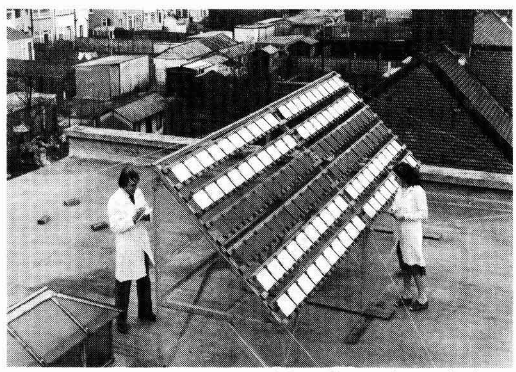


Automated invoicing, statements, stock control; information on stock levels, cash flow, customer credit status etc. from Autofact

50th Anniversary at the International Tin Research Institute

The Institute held an "open house" from 5-8 October at their Research Laboratories in Greenford on the occasion of the 50th Anniversary of the Tin Research Council. On 5 October Mr Cyrus Taihitu of Indonesia unveiled a

Large numbers of organotin compounds are synthesised in the Institute's laboratories for industrial screening



Steel panels coated with tin-containing primer paints under long-term evaluation at the Institute

pewter plaque and presented an opening address to an assembly including many distinguished figures from the world of tin.

The research and development laboratories were then opened to the visitors and the work in progress on all aspects of tin technology was displayed, including the tinning of PCB, alloys, solders, organotin compounds and tin-based corrosion inhibitors. In the application of tin compounds as corrosion inhibitors, work has progressed to the point where a number of paint companies are actively investigating formulations based on suggestions from the TRI; exposure panels on display indicated that this particular application should produce a fresh demand for tin products.

Reader Enquiry Service No. 26 — *D. S. Newton*

Further information on any items mentioned below is obtainable by completing the *Reader Enquiry Service* form at the back of the *Journal*.

news

Fall eases in UK domestic sales

"The falling demand for the industry's products, particularly the shrinking industrial market, provides the dominant theme of the past two years," according to a new business report on paints and varnishes from market analysts, Key Note Publications.

However, the report, which examines structure, size, trends and recent developments within the sector does have some encouraging news. 1981 saw a virtual halt in the downward trend in volume sales – only 0.8 per cent down compared to the 9 per cent plunge during the previous year. Returns for the first quarter of 1982 even show a 3.7 per cent increase in total paint sales compared to the very depressed level of the same quarter in 1981.

The market for paints and varnishes has traditionally been split roughly equally between the decorative and the industrial sectors. However, while the industrial market has been suffering from depressed demand, the decorative sector has weathered the current economic crisis relatively well. Of the two areas comprising the decorative market – the trade market, catering for professional decorators, and the retail market, catering almost entirely for DIY consumers – the latter has proved to be the industry's mainstay for volume sales during the current economic crisis.

The DIY paint sector, estimated to have a retail value in 1980 of £240m, now presents the consumer with an almost bewildering array of paints; there are silk or matt emulsions with varying degrees of washability, conventional and thixotropic gloss high build textured paints for interiors (textured paints have on the whole proved to be very successful recently), and masonry paints for exterior use. Emulsion paints constitute nearly 60 per cent of all DIY paints sold, with silk emulsions holding the largest share.

Colour is becoming a real selling point, and the actual selection of colour by the consumer is a very sophisticated business. Colour mixing machines, pioneered by Berger's Colouriser system and followed by the Dulux Matchmakers and Crown's Colour Cue range, are now installed in some 7,000 retail outlets. Crown's Matchpot scheme, launched last year, offering 25p trial-size pots and a refund against a subsequent purchase of a larger can, is reckoned to have boosted Crown's sales by as much as 25 per cent during 1981.

Off-white paints are among the latest commercial innovations of the paintmakers. Earlier this year ICI launched three new pink, cream and green tints in the guise of its "natural white" range, supported by a £1.5m television and £0.5m poster campaign. Crown soon retaliated with six new off-white emulsions in its own Misty shades range, while Berger proceeded to add 12 further off-whites to its original Colouriser system.

The report also notes that the last two years have seen considerable change in the area of corporate affiliation: there were more acquisitions during 1980/81 than during the entire preceding decade. Donald Macpherson & Co. Ltd emerged as the clear record holder, purchasing 14 companies between November 1979 and February of this year. A notable feature of several recent acquisitions by paint companies has been the push to foreign expansion. The overseas contribution to profits is now becoming an increasingly important factor for companies facing overcapacity in the home market.

The UK paint industry has in fact always been a substantial net exporter of paint, showing a satisfactory trade balance even when at its most depressed state in 1980. However, a growing import penetration has been undermining this favourable balance. Bulk exports are also beginning to be threatened by emergent paint industries in countries such as Korea, Taiwan and Nigeria.

Looking to the future in this area, the mature British paint industry is likely to do well out of the export of its know-how; as developing countries expand their manufacturing facilities, the demand for both British expertise, and specialist, higher value-added products will continue.

Reader Enquiry Service No. 31

New vehicle finishes plant

A technologically advanced plant for the manufacture of a new two-pack vehicle refinish paint, Acryline, has been opened at International Paint's Birmingham factory.

This new paint plant is the culmination of a two year project and represents an investment by International Paint of £300,000.

Situated in International's Ladywood site, the plant is already on stream producing International's brand new paint, which has been introduced in the North of England and will be launched nationally in March 1983.

The paint is the fruit of three year's joint development by International Paint chemists in the UK, Italy and Spain. It introduces a new range of two-pack acrylics to the refinish industry.

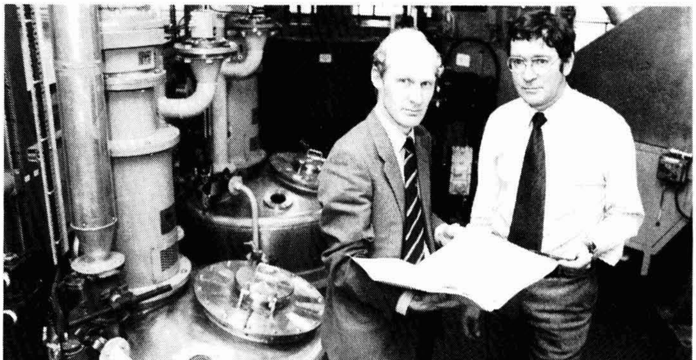
When it reaches full capacity, the plant will manufacture nearly 250,000 litres per year.

The manufacturing process itself is described as very advanced. The plant produces 24 basic colours (tinters) plus white for paint mixing schemes.

Most paint plants compromise between the demand for large batch quantities and the need to keep pigments separate during processing to eliminate colour contamination. This plant combines the best of both worlds with large stainless steel mixers and a system of high pressure solvent cleaning for vessels between mixes.

Absolute cleanliness is the rule and the plant also incorporates all the latest safety devices, with nitrogen purging prior to solvent cleaning and safety interlocks.

Reader Enquiry Service No. 32



New paint plant at International Paint's Ladywood site. "We are delighted with the quality of the plant" commented Mike Shipway (left), cellulose production manager, who, with project engineer Terry Brown (right), has been living with the development for over a year

news

Hercules builds new plant

Hercules has announced the construction of facilities at its Middelburg, Netherlands site for the production of hydrogenated rosin, hydrogenated hydrocarbon resins and a new line of C_5 hydrocarbon resins. The new facilities give Hercules multi-plant supply capability to the world markets it serves.

Production of C_5 hydrocarbon resins began in November 1982. These new resins compliment the existing C_9 aromatic resins and the specialty pure monomer resins already produced at Middelburg.

Operation of the hydrogenation facility will begin in 1984. Hercules says this new plant will strengthen its position as a major supplier of specialty tackifier resins used in the adhesives industry and will further emphasise its leading role as a supplier of specialty resins based on either rosin or petroleum feedstocks to the paint, varnish, graphic arts, paper, rubber, packaging and food industries.
Reader Enquiry Service No. 33

Colour quality control

In view of the ever increasing demand for colour instrumentation equipment concentrating on colour quality control and shade sorting, Instrumental Colour Systems have formed a new division to service this expanding market.

The new division will market a range of products based on the Macbeth 2020 Spectrophotometer measuring head, which are designed to enable companies who do not require full computer match prediction systems to both measure and evaluate colours.

The range will include both hardware and software integrated packages designed to meet customers' specific requirements, and will include the Micromatch Spectrophotometer, colour storage systems, shade sorting systems and controlled weighing terminals.
Reader Enquiry Service No. 34

Lawrence distributorship

Lawrence Industries is the new UK distributor for Fortrex micaceous extender. According to Lawrence this high brightness, platelike and fine particle size extender can be used in the production of a wide variety of paint systems giving improved mechanical strength, chemical resistance, better substrate adhesion, wash resistance, light fastness and resistance to chalking. Fortrex is a process-washed extender which is easily dispersed into paint systems and is widely used in Europe in the production of emulsion paints, aluminium bearing paints as an aluminium pigment spacer, in anti-corrosive paints where its platelike particle shape assists in the overall system protection, and is also used in anionic electro-deposition systems.
Reader Enquiry Service No. 35

Rhone-Poulenc (UK) distributors

Rhone-Poulenc (UK) has appointed K & K Greeff Chemicals as distributor of its emulsions designed for the paint and adhesives industries.
Reader Enquiry Service No. 36

New distributor for Binks in Scotland

Binks-Bullows Ltd has appointed Woodside Pneumatics Ltd, a subsidiary of Shanks and McEwan, to handle sales, service and distribution of spray finishing equipment throughout Scotland.

Woodside Pneumatics Ltd has been supplying and installing compressed air systems since the company was established in 1970.

The Binks-Bullows range of spray finishing equipment covers all types of application including heavy anti-corrosive coatings for oil rigs as well as light varnishes for quality furniture. The product range includes robots, automatic spray plant, spray booths and a full range of hand spray guns.

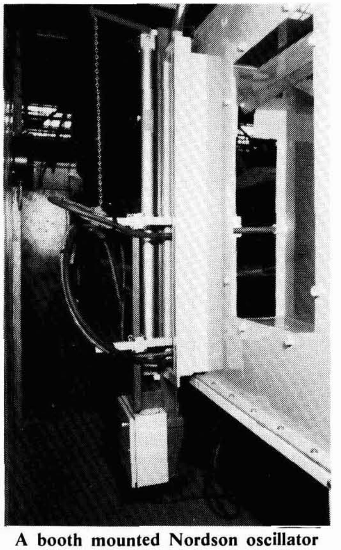
Binks' equipment complements the other products handled by Woodside, who are sole franchise distributors in Scotland for Hydrovane Compressors, Denco Air Driers and Ultrafilters. This equipment is incorporated into complete turnkey projects, engineered and constructed by Woodside's own labour force, who's customers include such well known names as Shell (UK), ICI, Distillers Co., Seagrams Corporation, British Leyland, British Shipbuilders and Rolls-Royce.
Reader Enquiry Service No. 37

new products

New version of LABCAL software

Applied Color Systems Inc. has introduced an updated version of LABCAL software for paint and coatings formulators. Designed for users of ACS Computer Color Control Systems, the software package lends speed and efficiency to creating new formulas, modifying existing formulas and storing and retrieving formula data. LABCAL is said to be able to double the output of formulators who use hand calculators only.

From basic information the program package generates laboratory formulas of a specified size, special instructions and QC specifications, and cost analyses of formulas. It will also calculate raw materials costs adjusted to any specified processing losses and/or special container fill. Finished formulas may be stored in memory on command and retrieved quickly and conveniently.
Reader Enquiry Service No. 38



A booth mounted Nordson oscillator with two automatic powder guns

Oscillator for powder coatings

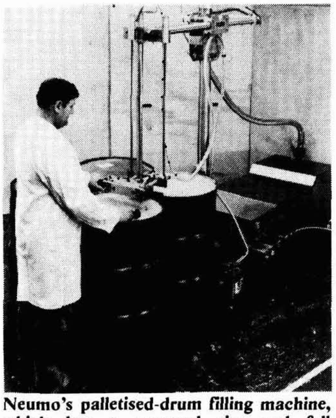
A new oscillator is being produced by Nordson. There are two versions, either a free standing unit with lockable castors or booth mounted. The units are available with stroke lengths of up to three metres, but one metre is said to be proving adequate for the majority of applications. Electrostatic powder guns may be stacked horizontally or vertically. A one metre stroke machine with guns stacked vertically can accommodate work heights of up to 1.7 metres.
Reader Enquiry Service No. 39

Adhesion tester

A new machine for testing the adhesion of paints and similar coatings – based on the stamp pull-off technique – is being manufactured by Erichsen GmbH. Its design and subsequent manufacture follows the international standardisation of this technique, the requirements of which the new machine is said to match.

Called the BAM Adhesion Tester it operates on a hydraulically produced tractive force which is increased by a uniform and load independent speed. The operating range is 0-45 N/mm^2 with an accuracy of ± 2 per cent. There are two versions of it available: one for use in the laboratory, and one with a carrying case for tests in the open air.
Reader Enquiry Service No. 40

news



Neumo's palletised-drum filling machine, which has a powered rise and fall mechanism

Drum filling

To speed up the in-place filling of large drums of up to 210 litres, a new semi-automatic machine has been developed by Neumo with a powered rise-and-fall mechanism.

Push-button control activates the filling cycle, which involves lowering the nozzle automatically to the required position and commencing filling. A timing mechanism raises the nozzle as the container fills without further operator intervention.

Automatic operation and cut-off allow the operator to uncap, cap and crimp other drums in the batch while filling is in progress.

The machine is particularly suited to bottom filling or foaming products.
Reader Enquiry Service No. 41

Carbon black dispersion

Degussa AG of Frankfurt am Main has developed a low-cost carbon black preparation for the dyeing of paper, cardboard, concrete, artificial stone, asbestos cement and building board. The 30 per cent aqueous dispersion of carbon black pigment has a jetness of 87 (Nigrometer index) and a tinting strength of 107 (according to DIN 53234). The new product is marketed by the Pigments business area of Degussa as "Carbon Black Dispersion 30".
Reader Enquiry Service No. 42

literature

XVI FATIPEC Congress

The book of the XVI FATIPEC Congress is now available. The theme of the Congress was: "Evaluation and foresight of film properties of organic coatings by the use of modern analytical methods" 9-14 May 1982.

The book – in four volumes (1,392 pages) – contains the complete texts of the 10 plenary lectures and the 54 short lectures presented during the week.

It can be obtained at a cost of 4,500 + 200 (postage) Belgian francs by ordering from: ATIPIC, Square Marie Louise 49, B-1040 Brussels, Belgium. Prepayment is required: account No. 210-0235175 of ATIPIC, Société Générale de Banque, Agence Dilbeek, Chssée de Ninove 84, B-1710 Dilbeek, Belgium.
Reader Enquiry Service No. 43

BIE Anticorrosion Ltd

BIE Anticorrosion Ltd has produced a very well illustrated brochure dealing with its activities.

These include the inspection of protective coatings, offshore installations, insulation and fireproofing, pipe coatings including powder coatings, and consultancy service. The latter service includes reviews of specifications and failure investigations, and is backed up by comprehensive laboratory facilities.

Numerous examples of work carried out by the company are shown including installations in the Middle East, North Sea and the Shetlands.

Information on the other companies in the group both in the UK and overseas and their activities is included.
Reader Enquiry Service No. 44

TC Inspection Ltd

This company has recently published a brochure on the services which it can provide in the field of quality control in surface coatings application. Details are available on training courses run by the company in such areas as paint and painting inspection, powder coatings application and testing, and offshore coatings, technology and inspection. Two courses are also available on cathodic protection. The company has been particularly pleased with the success of its ERS painting courses, its students having had a 100 per cent success rate in the British Gas ERS approval scheme.
Reader Enquiry Service No. 45

meetings, etc.

Paint RA conference

The theme of the paint RA's 5th International Conference will be: "Technological advances in the coatings industry" and will be held at the London Penta Hotel from 10-12 May 1983. For further information contact: Dip Dasgupta, Paint RA, Waldegrave Road, Teddington, Middlesex TW11 8LD, England, Tel: 01 977 4427.

people

Subsequent to the recent reorganisation of Reed International plc into ten operating groups, the following appointments have been announced in the Paint and DIY Products Group to take effect from 1 December 1982.

George D. Campbell, currently managing director of The Walpamur Company (Ireland) Ltd, is appointed managing director, Crown Paints.

In this capacity he will report to **Peter Burns,** chief executive of the Paint and DIY Products Group, who remains chairman of Crown Paints.

Before taking up his appointment in Ireland in 1980 Mr Campbell was marketing director, Crown Paints UK.

Ray Freshfield, is appointed finance director, Paint and DIY Products Group. This is a new appointment reporting directly to Peter Burns.

Mr Freshfield joins Reed after 15 years with the Brooke Bond Group where he held various accounting and management positions in the UK, Africa and North Amercia.

In addition to Crown Paints UK and overseas operations, the Paint and DIY Products Group includes Polycell, General Paints of Canada and Parker Paints in the USA.

★ ★ ★

Richard Jay has been promoted to export sales manager of Binks-Bullows Ltd, Brownhills, Walsall, West Midlands.

In his new post, Mr Jay (29), formerly technical services manager, will be responsible for Binks' total export effort.

Binks-Bullows manufacture a wide range of manual, robot-based and automated spray painting equipment which is used in all types of industry and especially in volume car production, car repair and refinishing. Mr Jay will supervise a network of agents and distributors to further promote the already well established export sales.

★ ★ ★

Inmont Ltd has announced the appointment of **Mr C. J. Price** and **Mr G. Heath** to the board of directors.

Clive Price joined Inmont as quality control manager in May 1961, progressing to production manager, then manager of manufacturing, and since 1978, production director responsible for manufacture.

George Heath joined Inmont in March 1973, commencing as marketing manager of the Refinish Division at its inception. In 1978 he was given the added responsibility of chairman of Refinish Marketing Group for Inmont Europe. Since 1981 he has been managing director of H. T. Wells, a major vehicle refinish factor and fully owned subsidiary of Inmont.

● ● ● ● ● ● ● ● ● ● ●

SLF – Congress 10

The Federation of Scandinavian Paint and Varnish Technologists held their 10th Congress in Copenhagen from October 11-13 1982. The level of interest was high with almost 250 technical participants and about 100 wives and guests attending social activities. Those attending were drawn largely from Scandinavia, the 15 from other countries being mainly invited lecturers and their wives. The UK was represented by Tom Bullett of Paint RA and Tony Johnson of PIRA. Unfortunately the OCCA President was in South Africa attending the South African Division Convention, but one of the Vice-Presidents, Henryk Furuhjelm, from Finalnd, was much in evidence.

The technical programme was well balanced with papers generally of a high quality. The first day, conducted entirely in English, included most of the invited papers on general topics of paint technology. After a welcome from the President of SLF, Gert Thomsen, there was a short keynote lecture by Erik Eikers, formerly of Hempels, who urged the paint industry to remember and teach its chemistry. Two papers on "Wood as a substrate for coatings" by Prof. Wilfred Côtè of the University of New York and "Wood protection by coatings" by Dr helmut Haagen of the Forschungsinstitut, Stuttgart were a particularly happy combination. Prof Côtè gave an excellent review of the chemistry and morphology of both pines and hard woods with some beautiful electron micrographs of structural detail. Dr Haagen discussed the interactions between joinery design, exposure conditions, wood structure and coating performance. Both speakers stressed the importance of regulating water movement and protecting most woods from ultraviolet and shortwave visible radiation. Paint adhesion failure through attack of lignin or cellulose by bacterial enzymes under the coating was also discussed. Dr Haagen reported on a programme of cyclic testing of emulsion paints, semi-transparent stains (both emulsion and alkyd types) and alkyd paints designed to indicate the most suitable types for specific wood protection requirements. In discussion there was some disagreement with the lecturers who both predicted that the most effective paint systems for wood should penetrate well into the wood structure, questioners argued that chromatographic separation could weaken films dangerously.

Dr Dan Perera of the Coatings Research Institute, Belgium reviewed his work on the effects of pigmentation and of solvent variation on internal stress in coatings. The study used a polyisobutyl methacrylate resin as a model binder. Internal stress on drying was shown to reach a sharp maximum at a critical PVC, falling away rapidly beyond this, presumably due to crack relief. Internal stress was found to start at the point where solvent loss became controlled and to rise more rapidly and to higher maxima with the more volatile solvents.

Tom Bullett of the Paint RA, speaking also on behalf of OCCA, discussed the need for realism in paint testing with specific reference to adhesion (where pull-off test figures do not necessarily indicate likelihood of adhesion failure), corrosion testing (where interrupted cycle tests are proving more valuable than the presently specified continuous salt spray tests) and durability testing. The final paper of the day by Sepp Wilska of the Lappeenranta University of Technology dealt with the mineralogy and the winning of heavy mineral sands as raw materials for the paint industry and, in particular, his experiences as a UNIDO expert in Sri Lanka.

For the second day the conference split between two meeting halls. In one, most papers were delivered in one of the Scandinavian languages with very competent English translation; in the second, papers mainly on printing ink or printing topics were presented in English without translation. In view of the considerable language concessions SLF had made to overseas participants the low level of attendances by native English speaking participants was unfortunate. However, it must be remembered that most Scandinavian scientists and businessmen speak and understand English, often more readily than some of the other Scandinavian languages.

The papers presented on the second day included the second from England by Tony Johnson of PIRA who discussed problems of colour differences between litho proofs and production prints, basing his talk on a study of dot size gain made by PIRA. There were also first class papers on NMR spectroscopy in paint and varnish analysis (from NIF), photocrosslinking, self polishing copolymers for antifouling, the choice of water or solvents for printing inks and on particle formation and stability in polymer emulsions. Perhaps the most interesting, however, were reports on biological effects after short time exposure to aliphatic and aromatic hydrocarbons, and in the final paper some predictions on the technological revolution in the graphic arts. Scandinavian and Russian studies have been building up evidence of long term damage to nervous systems resulting from occupational exposure to paint solvents. Now, exposure chamber experiments at the Danish National Institute of Occupational Health have confirmed short term effects of exposure to white spirit in the range 0-400 ppm which are significantly dose related, suggesting that threshold limit values for white spirit should be reduced. Many technologists at the conference were actively planning moves away from the use of white spirit through high solids, water thinned paints or the use of alcohols.

In the final paper, Ole Brinch predicted changes in the graphics industry in the next ten years which will be revolutionary after the evolution of the last five hundred years. Already, computer controlled micro spray printing has been introduced and other techniques will soon replace traditional type setting and painting methods.

Throughout the Congress, organisation was excellent and the social events, culminating with a banquet attended by some 300 people, were most impressive and enjoyable.

Much of the credit must go to Gert Thomsen, in overall charge, Gunnar Chistensen, who organised the lecture programme, and Mike Symes of Sadolin and Holmblad whose use of computer programming in the Congress office was most successful. The program was quickly collected by Norway for the next congress and could well be of interest to other major conference organisers.

Altogether it was a most successful and impressive conference. By only "SLF 10" Scandinavia has clearly matured as a major conference venue for paint technologists, it is to be hoped that many more UK people will attend SLF 11 to be held in Oslo in 1985.

Tom Bullett

occa news

Information regarding membership of OCCA is obtainable from the Association's offices, see contents page for address.

OCCA CONFERENCE 1983

The efficient use of surface coatings

As already announced in the *Journal*, the next Biennial Conference of the Association will take place at the Viking Hotel, York from Wednesday 15 to Saturday 18 June 1983. The title of the Conference will be "The efficient use of surface coatings". Summaries of most of the papers and biographies of the lecturers will appear in the January 1983 issue. The programme for the technical sessions is as follows:

Session I "Formulation including manufacture"

Thursday 16 June 9.15 a.m.–12 noon — *Chairman: Mr J. R. Taylor (Hon. Research & Development Officer)*

Keynote address — *By Mr R. A. Fidler (International Paint PLC)*

Surface coatings in relation to external insulation — *By Dr M. Wilkinson (Blundell Permoglaze Ltd)*

The need for speed and accuracy in the formulation and production of efficient surface coatings — *By Mr R. J. McCausland (Bayswell Consultants)*

Automated paint manufacture — *By Mr W. Ollett (Crown Decorative Products)*

Linear polymonosulphide and polysulphide polymers – general survey recent developments and applications *(paper presented on behalf of FATIPEC) By Prof. Brossas (University of Louis Pasteur)*

Session II "The use of computers and other advanced techniques in surface coatings"

2.00 p.m.–4.30 p.m. — *Chairman: to be announced*

Introduction to computer technology — *By Mr G. T. Eady (Ault & Wiborg Paints Ltd)*

Solving paint problems with computers — *By Mr H. J. van der Stoep (Sikkens Ltd)*

Introduction of microprocessors in surface coatings — *By Dr A. Carrick (Kratos Ltd)*

The use of NMR in the characterisation of polymers used in surface coatings — *By Dr M. Marshall (MQAD)*

Efficiency and change in metal decoration — *By Dr A. Gamble (J & C Ink Co. Ltd)*

Session III "Maintenance of quality and prediction of performance"

Friday 17 June 9.15 a.m.–12 noon — *Chairman: Mr T. Graham*

Quality control and standardisation in the titanium pigment industry — *By Mr R. Blakey (BTP Tioxide Ltd)*

Prediction of performance of exterior wood coatings — *By Dr E. R. Miller (Building Research Station)*

Prediction of salt spray results from formulation parameters *(paper presented on behalf of FSCT)* — *By Dr F. L. Floyd (Glidden Inc.)*

Acoustic emission – further unpublished results of the new technique for the study of paint performance during environmental exposure tests — *By Mr T. A. Strivens (ICI Paints Ltd)*

Wood protection – the interaction between substrate and product and the influence on durability *(paper presented on behalf of SLF)* — *By Mr K. Kleive (A/S Jotungruppen)*

Session IV "The efficient use of coatings application"

2.15 p.m.–4.15 p.m. — *Chairman: Mr F. H. Palmer*

Quality control of application of coatings and technical developments which have occurred — *By Mr D. Bayliss (ITI Ltd)*

The use of modern application equipment and its efficiency — *By Mr M. Eaton (Kremlin Spray Painting Equipment Ltd)*

Paint finishing in the car industry — *By Mr H. L. Quick (Talbot)*

Fire retardancy of coatings systems and application techniques — *By Dr F. G. R. Zobel and Mr D. Bishop (British Railways)*

In keeping with earlier Conferences the 19 papers are of a very high standard, 9 of which will be presented by lecturers from paint and printing ink companies.

York Conference 1983 – summaries of papers and biographies of authors

Keynote address

R. A. Fidler

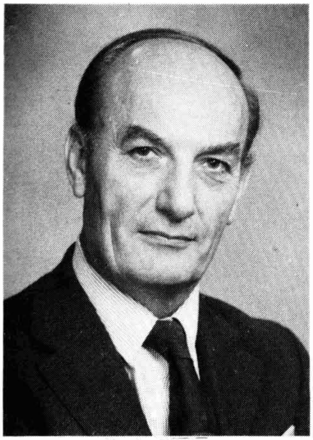
Biography

Mr R. A. Fidler has spent 35 years in the metal finishing industry and his experience has covered most aspects from user, specifier through to supplier.

Most of that time has been in the field of industrial paints with the International Paint Company (IPC) and Mr Fidler has concentrated on sales and marketing roles in Canada, the UK and Europe; embracing a wide variety of products and industries.

Mr Fidler, having held senior positions within IPC, is now employed as a consultant and was the first chairman of the Industrial Executive of the Paintmakers Association.

Anyone wishing to receive a copy of the Conference brochure – which contains full details of the Conference – should contact the Association's offices at the address or telephone number shown on the contents page.



R. A. Fidler

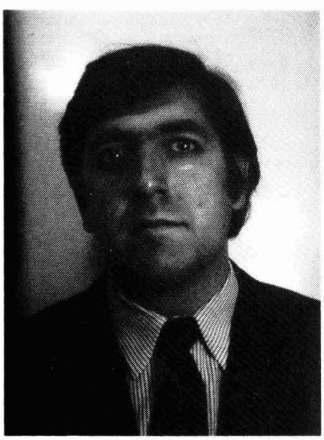
Surface coatings in relation to external insulation

M. Wilkinson

Summary

The influence of external wall insulation and the performance criteria of the decorative protective coatings applied over the insulation materials will be analysed. Particular attention will be directed towards solar gain and the affect of thermal stresses, fire performance of the systems, water vapour permeability, impact resistance and the factors affecting the bonding of the coatings to the insulation.

The long term durability of these systems will be discussed, together with the important aspect of on-site control.



M. Wilkinson

Biography

Approximately eight years before going to university Dr M. Wilkinson worked on the production of di- and tri-cellulose acetate and on the coating of both cotton and paper with PVC films.

He obtained an honours degree in chemistry from Lancaster University followed by a PhD on the organometallic chemistry of gallium.

After leaving university he became involved in the performance and production of cement additives and adhesives for the building industry, after which he spent a number of years looking at new and improved surface coatings both in the decorative and industrial fields.

Dr Wilkinson is at present the Vice-Chairman of the External Wall Insulation Association and the general manager of the Building Insulation Department of Blundell-Permoglaze situated at Preston.

occa news

The need for speed and accuracy in the formulation and production of efficient surface coatings

R. J. McCausland

Summary

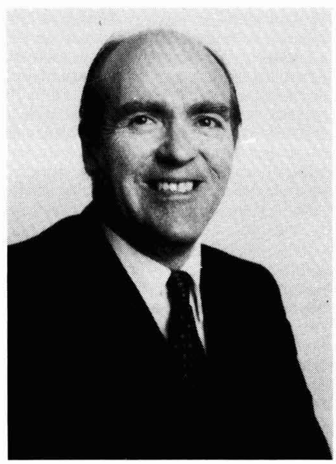
In general, the technical branches of the surface coatings industry have tended to fall behind their administrative counterparts in the automation of procedures. Thus many laboratory and related production and quality control operations remain essentially manual, relatively slow in operation and not always well integrated. It is not uncommon for a factory to be making products which do not agree exactly with the master formula in the laboratory nor the cost accountants records; this leads to erroneous gross profit calculations and stocktaking surprises, not to mention over or under production giving surplus quantities.

The paper deals with modern techniques which allow experimental formulations to be costed during evaluation in the laboratory, and these, the final version and subsequent modifications, to be fed smoothly and rapidly to production units via video screens, with machine procedures and handling losses being varied to meet actual factory practice. Safety information and handling precautions are automatically calculated, and labelling requirements to meet the EEC Hazard Warning legislation indicated without exhaustive arithmetic. Integrated with these procedures, which include the computerised production of batch cards, are efficient individual batch costing procedures, giving exact gross profit figures and good stocktaking correlation; this also gives better material control within the factory and lower handling losses.

Also described in this paper are possible ways of speeding actual paint production by processor control of certain critical aspects such as small batch manufacture, going some considerable way beyond present instrumental techniques using spectrophotometers. The profound effect of this on established solutions to equations involving economic batch size related to normal stock replenishment cycles is investigated; comparisons are illustrated using a stock profile technique.

The influence of these novel approaches on present procedures for production planning, customer liaison, regulation of raw materials and container purchases is described, resulting in improved communications.

Most importantly in the light of present day bank interest rates, the overall potential reduction in stock levels, and consequently in financial charges, resulting from a faster throughput is clearly demonstrated. An annual saving equivalent to about one per cent or more of the yearly raw materials bill is often found possible; to equal this in labour savings would mean a reduction of approximately 10 per cent in the workforce! The relationship between these potential savings and the capital costs of available computerised systems is discussed.



R. J. McCausland

Biography

Born in Scotland in 1932, Mr McCausland has over 30 years of practical experience in industry, initially involving detailed laboratory work "on the bench", as managing director of several medium sized companies and finally as a member of the board of management of a large multinational company with an annual turnover of approximately £100 million. He has worked in small compact units, employing 50 to 250 persons, and in international organisations employing many thousands.

occa news

Mr McCausland has been involved at senior management level in most company disciplines.

In selling and marketing, he spent five years on export selling into the paint, plastics, paper and textile industries, mainly in continental Europe, and more recently has specifically developed specialist worldwide markets such as off-shore construction, marine and anticorrosion, nuclear power, pre-coating of steel coil, sealants, refinishing systems for cars and heavy transport freight containers, fireproofing of structures etc. His experience also embraces selling through merchants and distributors as well as directly to retail outlets in the DIY sector.

He has also personally negotiated major engineering contracts and guarantees, working closely with legal advisors, quantity surveyors etc. and controlling site inspection services and subcontract labour.

On the purely technical side, Mr McCausland has successfully run various organisations including customer service laboratories advising clients on optimum product usage and troubleshooting, production quality control, and a research and development unit with a staff of 100 equipped with sophisticated tools such as gas chromatography, infrared absorption and x-ray spectroscopy as well as physical testing equipment, colour computers and so forth.

One of his specialist fields is material management, covering purchasing, manufacturing and distribution. On the buying side, he has been personally responsible for an annual purchasing budget of approximately £30 million and additionally has developed and coordinated multinational contracts bringing substantial cost savings. In production, Mr McCausland has directly run factory units in the UK and in Holland, covering all aspects of industrial relations, recruitment, motivation, cost price systems, automation and administration; in every case he has achieved notable improvements in productivity and effective material usage. He has presented and supervised annual investment budgets of approximately £2 million and also controlled major projects involving expenditure of up to £7 million. On distribution he has introduced balanced manual/automated warehouse systems to provide optimal customer service, together with relevant recording procedures.

Latterly, Mr McCausland has concentrated on general management with directorships of companies in the UK, Holland, Belgium, Hong Kong and Singapore. Earlier, as managing director of a UK company with 250 employees, he introduced a new computer system covering order entry, invoicing and bookkeeping (including multicurrency accounting), stock control and statistics. More recently he has led study groups on the introduction of computerised techniques for production and purchasing procedures and has experience of IBM software such as copics, mapics, etc. as well as more compact systems for smaller users, and specialist developments such as EEC safety labelling.

However, it is in the field of change that he has specialised, with emphasis on the organisational and human problems which accompany company mergers or major internal reorganisations of production allocations; which themselves bring benefits but require careful liaison with staff and workforce at all levels. He has personally supervised several merger operations and one major production reorganisation, utilising the latest continental techniques of labour relations.

Automated paint manufacture

W. Ollett and J. Boyden

Summary

When considering the design features of a large modern paint manufacturing unit a number of objectives have to be borne in mind. These include the efficient use of raw materials and labour, the ability of the total plant to respond quickly to changes in demand, improvement of quality standards, efficient use of manufacturing equipment, and reduced levels of "in process losses". At the same time, advantage must be taken of an opportunity to improve the working environment by reducing the occurrence of dirty arduous tasks, e.g. bag handling.

It is a fact that these conditions can only be satisfied if the whole manufacturing process is strictly controlled and random human errors are eliminated. This state is best achieved by the introduction of mechanical handling methods and the use of microprocessors or computers for process monitoring and control.

The dedicated process control computer can be utilised to store formulation data along with full manufacturing instructions, distribute and measure raw materials to the appropriate equipment, route "in-process" product to the thinning tank, log the batch and cumulative raw material consumption, as well as to control stock levels in the warehouse.

Biography

Walter Ollett commenced employment with Crown Paints in 1967 after previously working for English Electric

W. Ollett

Company Limited and a subsidiary of Reckett and Colemans who manufactured perfumes and flavours.

On joining Crown Paints he worked in the Industrial and Decorative Paint laboratories where duties included liaison with production departments during the introduction of new products. This aspect of his work eventually led to a transfer to Site Operations, where he gained more experience of manufacturing techniques and factory trouble shooting.

During the past three years he has worked in the Divisional Operations Development team, latterly almost exclusively on the new plant recently commissioned at Darwen.

Biography

J. Boyden joined Crown Paints Division in 1970 after periods of employment with ICI and Unilever. He is a qualified chemical engineer having graduated from

J. Boyden

Manchester College of Science and Technology in 1960.

Since commencing employment with Crown Paints he has been responsible for all aspects of process development over the whole range of factory operations. Development work has included such diverse areas as powder and material handling, installation of polymer production plant and packaging machinery, together with the design of complete paint plants installed at Darwen and Haltwhistle sites. Additionally, he was the major contributor to the design of a factory and warehouse complex in Dublin.

During the past two years his efforts have been concentrated on the new £3,000,000 oil paints plant now operational at the Darwen site.

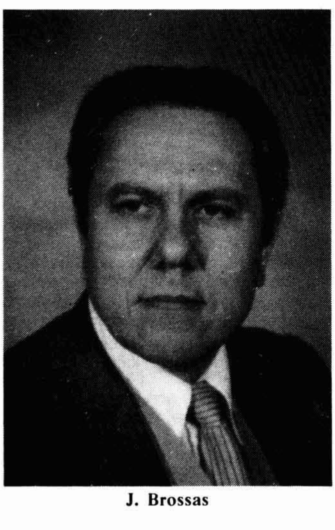
Linear polymonosulphide and polysulphide polymers – general survey, recent developments and applications

J. Brossas

Summary

Research into sulphur containing polymers has recently increased considerably. This is because there are many different sulphur containing functional groups with a wide range of chemical and physical properties which are important in many industrial applications.

The inclusion of sulphur in the backbone of hydrocarbon polymers can result in unusual properties when used as moulding resins, as adhesive coatings and as elastomeric coatings. The synthesis of polymer polysulphides is discussed, and to illustrate the structure of the polymers, studies using molecular models are described in detail.



J. Brossas

Biography

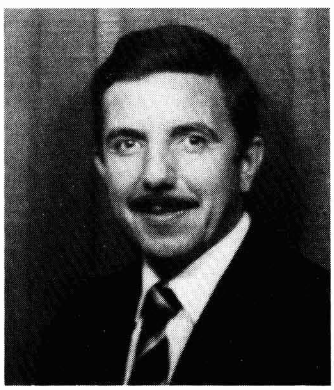
J. Brossas graduated from the Caen University in 1959. From 1960 to 1969 he worked at Le Mans University on methylene cyclobutane polymerisation, and prepared isopolyisoprene which is an isomer of polyisoprene. In 1969 he received his Doctorate of Sciences. From 1972 to 1982 he headed research at the Macromolecular Organic Synthesis Laboratory in the Centre de Recherches sur les Macromolécules at Strasbourg. His research covered functionalisation of polymers, telechelic oligomers and flame retardant polymers. He was also Professor of Chemistry at the Louis Pasteur University of Strasbourg.

Introduction to computer technology

G. T. Eady

Summary

Computers are becoming more and more a part of our everyday lives and yet few of us know how to operate and program them and even fewer know how they actually work. The result for most of us, therefore, is to develop an arms length only relationship with them. The object of the paper is to break the computer down into its component parts and to simply and briefly explain how each part works. Common computing terms are also covered within the context of the explanation. The object of the presentation is to further develop the content of the paper to see how the interaction between man and machine operates.



G. T. Eady

Biography

Graham Eady graduated in general science from the University of London in 1969 and after a couple of years in industry returned there to take a masters degree in management science. He trained as an industrial engineer and work study practitioner and spent some years experiencing life on the shop floor as a foreman. Most of his early experience was with electronics companies and he has only recently come to the paint industry via freelance management consultancy and printing. He currently works as production services manager with Ault & Wiborg Paints Ltd.

Solving paint problems with computers

H. J. van der Stoep

Summary

In a well-known basecoat clearcoat system for car refinishing unexplainable complaints concerning adhesion occurred from time to time. The problem was the stripping of the clearcoat from the basecoat. These complaints resulted in rather large damage claims and therefore an investigation was begun to solve this adhesion problem. This investigation was hindered by the fact that the results were unpredictable; the same experiment led to different results when performed by different sprayers. Therefore an investigation was started based on statistical principles. During this investigation more than 800 panels were sprayed and about 20,000 results were processed with the aid of a computer with a P-stat program. So called statistical designs were used. With these designs it was possible to establish the experimental error and to find the significant factors and interactions. Thus after a series of experiments the cause of the adhesion problem was unravelled and traced to two application factors; in the first place the time between spraying the basecoat and the clearcoat and in the second place a use of a spraying technique that was too dry. In practice this situation will also occur as the sprayer adjusts his spraying technique automatically to suit different colours. Thus, when the cause of the adhesion problem was clear, several actions were taken: customers were warned of the danger of too long an interval between the spraying of the basecoat and the clearcoat, also the formulation was changed to reduce the danger of spraying too dry.

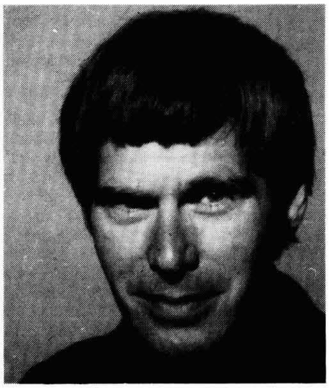
Biography

Henk van der Stoep was born in Rotterdam in Holland. After the customary primary and secondary education he went to Leiden University to study organic chemistry. The main topics he covered were photochemistry and theoretical chemistry.

After completing his studies he went to Delft University of Technology as a research assistant, concentrating on subjects such as radical chemistry and dye chemistry.

Since 1979 he has been employed by

occa news



H. J. van der Stoep

Sikkens, an important Dutch paint manufacturer, where he is responsible for the development of car refinishing products.

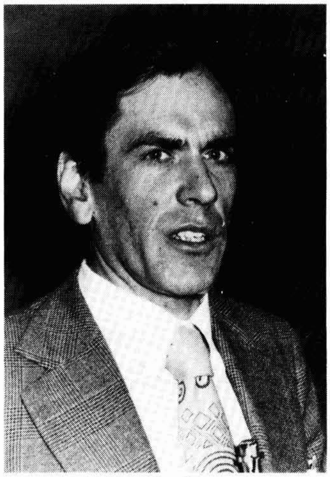
Introduction of microprocessors in surface coatings

A. Carrick

Summary

The usefulness of any material is largely dependent on the nature and properties of its surface. Surface coatings function to protect, decorate, separate and join, and the chemical and physical interactions and mechanisms of these processes are often imperfectly understood. New and more powerful analytical instruments based on photoelectron and particle impact spectroscopies can provide fresh information on both macroscopic and microscopic scales. In common with many spectroscopic techniques, detected fluxes are relatively low, despite manufacturers continued efforts to improve them, and so every possibility of enhancing the signal to noise ratio, using new analysers, multiple processing, or multiple detector systems, must be adopted. The computer has a clear role here and is being progressively integrated with the instrumentation taking over more and more of the housekeeping or routine activities for both "one off" and routine analyses.

An outline of the role of the latest generation of powerful computers in this instrumentation together with new applications related to novel detector systems and automatic sample handling techniques will be presented, together with practical applications of total systems.



A. Carrick

Biography

Dr Carrick began using mainframe computers in 1964 to provide fundamental data on isotope distributions for chemical analysis and has been progressively more involved with computers ever since. During a research fellowship (and later permanent post) at the National Physical Laboratory, he was responsible for the introduction of on-line minis to a variety of instrumental procedures and served on a number of Government committees on minicomputer and data handling applications. As technical manager of INSTEM Ltd, he shepherded the introduction of minicomputers to many laboratories of major companies throughout the world, including breaking new ground with on-line instrumentation systems for toxicology. A period as Applications laboratories manager and data systems products manager at KRATOS Ltd, Manchester, with responsibilities for new systems development (with software and hardware), preceded his present appointment in international marketing.

Author of 12 technical papers, and holder of a patent (for an "intelligent" interface), his first book "Computers and Instrumentation" (Heyden and Son) was published in 1980.

The use of NMR in the characterisation of polymers used in surface coatings

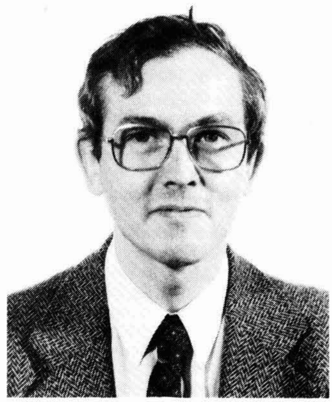
M. Marshall

Summary

Examination of a range of uncured paint media has shown that valuable information can be obtained by ^{1}H-NMR. Phthalate isomers and common modifying agents such as styrene, vinyl toluene, or silicone can be identified and quantitatively determined. Drying oils can be classified into several technically significant types such as "linolenic rich", "simple linoleic rich" e.g. soya bean oil, "complex linoleic rich" e.g. dehydrated castor oil, "eleostearic rich" e.g. tung oil, or "non-drying". Oils can also be quantitatively determined. The successful quantitative analysis of several alkyds, modified alkyds and epoxide esters is discussed.

The ^{1}H-NMR technique compares favourably with conventional procedures and has now been used for the routine quality assurance of paints for several years.

Some examples of ^{13}C-NMR spectra of paint media are discussed to illustrate the future potential of the technique.



M. Marshall

Biography

Maurice Marshall received his BSc from Nottingham University in 1969 subsequently gaining an MSc from the University of Bristol in 1970 and a PhD in analytical chemistry from Imperial College, London, in 1972. After three years with Laporte Industries at Widnes, he joined the Materials Quality Assurance Directorate of the Ministry of Defence at Woolwich in 1975. His initial interest at MQAD was the application of NMR and mass spectrometry to the analysis of real samples. Since 1980 Dr Marshall has been head of the paints research section at MQAD.

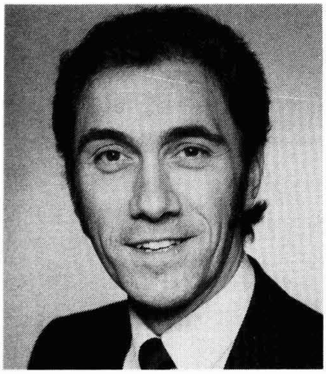
Efficiency and change in metal decoration

A. Gamble

Summary

The last decade has seen significant changes in the decoration of metal, both from the processes involved and the ink technology employed. This paper covers both areas and links the changes in container design and manufacture with associated ink performance requirements and chemical significance. Besides examining the current and past changes, the author considers possible future routes to container decoration.

occa news



A. Gamble

Biography

Dr Gamble is the technical director of J. & C. Printing Inks Ltd, a position he has held since 1980, and is based at their Stratford (London) headquarters. Prior to joining this company in 1978, he had spent six years in the printing ink industry, where he considers he served his "apprenticeship".

Dr Gamble graduated from Loughborough University of Technology in 1967 with a degree in industrial chemistry. Research work was then undertaken at the University of Essex where he gained his PhD degree in 1970. This was followed by a period at Harvard University in Boston, USA as a research fellow at Massachusetts General Hospital.

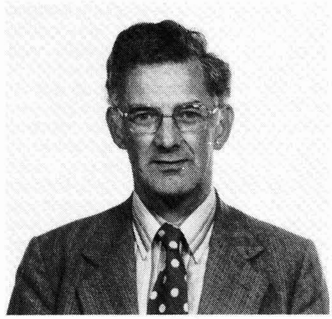
Quality control and standardisation in the titanium pigment industry

R. R. Blakey

Summary

All manufactured products must be suitable for the markets for which they are intended. The International Standards Organisation (ISO) is responsible for a wide range of specifications for both raw materials and finished products and many national standards organisations adopt and sometimes adapt appropriate ISO standards for their own use.

It is the author's opinion that internal specifications are much more meaningful than those imposed by outside organisations. The number of grades of titanium pigments is so great that it is difficult to see how they can be covered by a single specification. In the long run it is the customer who will decide whether a product is satisfactory and specifications must accurately represent his needs. Thus, the best means of quality control is via specifications imposed either by the manufacturers or by their customers and mutually agreed. It can easily be demonstrated that improvements in raw materials have occurred partly because of competition within the industry and partly through customer demands.



R. R. Blakey

Biography

After graduating in physics from the University of Manchester in 1950, Reg Blakey joined the Technical Service Department of British Titan Products Co Ltd. Since then he has been involved in the development of test methods for the physical evaluation of titanium pigments and pigmented materials, and is currently assistant technical service manager of Tioxide UK Ltd in charge of all paint applications. His extramural activities include service on BSI and ISO committees concerned with paint and pigment testing, where his interests in optical properties and dispersion have been particularly useful. He has presented a variety of papers in many parts of the world including the OCCA lecture to FATIPEC in Amsterdam in 1980.

Prediction of performance of exterior wood coatings

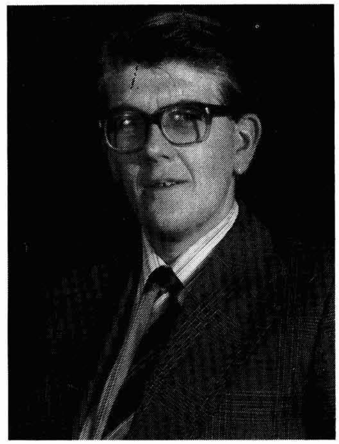
E. R. Miller

Summary

Although wood has been used as a building material since the dawn of man, the effective surface protection of wood components remains a source of considerable difficulty. This is partly a result of changes in wood and in the way in which it is used in modern buildings, and of a failure to take account in the formulation of coating systems of the requirements of wood as a substrate. The lack of accepted methods for predicting performance also hinders advance. This paper will review the factors underlying the performance of coatings on exterior wood, and will discuss methods of predicting the performance of natural and opaque wood finishes.

Biography

Dr Roy Miller joined BIP Chemicals Ltd in 1955 and for nine years worked on various aspects of amino and polyester resin technology. In 1962 he obtained a BSc after part-time/sandwich course study, and two years later became a research assistant at the University of Aston in Birmingham where he gained a PhD for research on ionisation in flames. In 1968 he joined the Forest Products Research Laboratory, now the Princes Risborough Laboratory of the Building Research Establishment. He has since been mainly concerned with the protection of exterior wood by preservatives, paints and stains, and has a particular interest in pretreatments for improving the characteristics of wood as a substrate, and its resistance to photodegradation.



E. R. Miller

Prediction of salt spray results from formulation parameters

F. L. Floyd and R. G. Groseclose

Summary

A variety of theories have been advanced in the literature to explain the failure mechanism of organic coatings applied to steel substrates. These theories have typically sought to explain performance based on single film properties and have been relatively unsuccessful. This paper presents a progress report on our attempt to predict the corrosion protection behaviour of coatings based on the combined relationships among several film properties and salt spray results. The film properties studied were permeability to water and ions, stress-strain behaviour, wet and dry adhesion, and electrochemical behaviour of the steel substrate in the presence of the liquid paint and the dried film.

The overall salt spray rating had little correlation to any one film property. Using multiple correlation techniques, a

occa news

model was developed involving barrier properties and electrochemical interaction between the applied paint and the steel substrate. This model produced a correlation of 0.90, which was significant at the 99.9+ per cent level.

F. L. Floyd

Biography

After studying chemistry at the University of Kansas, Lou spent five years with the Rohm & Haas Company engaged in R & D of emulsion polymers for coatings end-use. Since 1972, he has been with Glidden Coatings and Resins, a Division of SCM Corporation, where he is the technical manager of the Coatings Research Department. Lou is a member of the American Chemical Society, the Cleveland Society for Coatings Technology, the Editorial Review Board of the *Journal of Coatings Technology*; is a recipient of the Roon Award; and has 40 papers and presentations in the field of coatings science and technology. His current research interests include corrosion control via organic coatings, multiple parameter modelling of coatings behaviour, and heterogeneous polymer systems.

Acoustic emissions – further unpublished results of the new technique for the study of paint performance during environmental exposure tests

T. A. Strivens

Summary

The technique known as acoustic emission is a non-destructive method of detecting and analysing noise emitted as a result of sudden movements within a material. The most familiar application is the detection of cracking within materials under mechanical stress, e.g. aircraft wings, high pressure vessel walls, welds etc. ICI (Paints Division) plc have for the past five years pioneered the application of the technique to the study of paint failure during environmental exposure tests with very encouraging results.

A description of the apparatus and experimental procedure for applying the technique to paint specimens will be given and this will be followed by a full selection of results with various paint specimens during the course of various exposure tests.

Finally, an assessment of the usefulness of the technique will be given, together with an indication of future work.

T. A. Strivens

Biography

Born in 1934, Mr T. A. Strivens was educated at Plymouth College and Taunton School. He read botany and chemistry at the University of Wales (Cardiff) and graduated in 1955 with a BSc.

He was then employed by W. G. Pye and Co. (Cambridge) doing research into electrochemical methods of chemical analysis and later he joined ICI (Paints Division) Research Department at Slough in 1963 to do fundamental research into the electrodeposition of paint. Since 1970 he has been doing research into the mechanical properties of paint films and all aspects of the rheology of paint and paint components. His current research interests are in the rheology of concentrated polymer solutions and concentrated suspension and dispersion systems; he was promoted to group leader (Physics) in 1979.

Mr Strivens was elected to the Council of the British Society of Rheology in 1980 and is a member of the (American) Society of Rheology.

He is interested in classical archaeology, music and literature and is an active squash player.

Wood protection – the interaction between substrate and product and the influence on durability

Å. Underhaug, T. J. Lund and K. Kleive

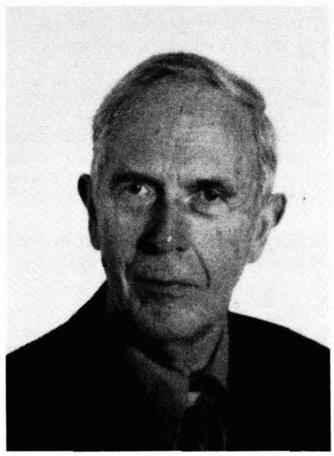
Summary

Ten years outdoor exposure tests of several hundred panels showed surprising results. The weathered surfaces became unsuitable for paint application much sooner than expected.

Many of the wood and paint technologists have not realised how fast a wooden surface degrades when exposed to normal weather conditions – sunshine, rain and micro-organisms.

It is also shown how difficult it is to recondition a degraded wood surface.

The condition of the wood surface is of paramount importance when seeking long lasting protection.



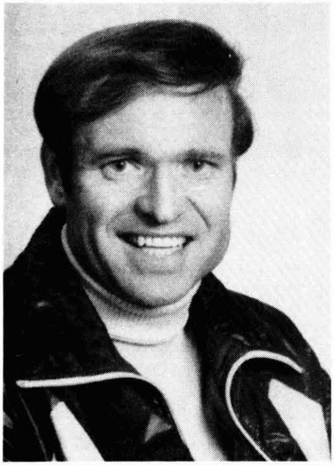
Å. Underhaug

Biography

Ådne Underhaug was educated at the technical university in Trondheim in 1941. He served with the British Army and then joined Fleischers Kjemiske Fabrikker in 1946 and is still working with the same firm – which now is part of Jotungruppen. He has published several papers on house paints.

Biography

Tore Jan Lund graduated in chemistry at the Bergen Technical School in 1965 and has since then worked with Fleischers Kjemiske Fabrikker – now Jotungruppen – where he has specialised in wood stains. He is the co-author of a paper presented at FATIPEC on wood protection.



T. J. Lund

Biography

Kaare Kleive graduated in 1958 in chemistry at the Technical University Graz, Austria. He began his work in the paint industry with Jotun Fabrikker, Norway and later stayed for some years

K. Kleive

with Becker, Sweden. After a period of seven years at Jotun Thailand Ltd, he is now overseas technical manager and senior chemist in the R & D department of Jotungruppen, Norway.

Quality control of application of coatings and technical developments which have occurred

D. A. Bayliss

Summary

The paint industry of today can now make coatings to meet almost any requirement. Over the last 20 years the advances in polymer technology have been revolutionary but, it is suggested in this paper, the method and quality control of coatings application have not necessarily kept pace. "Failures" of protective coating systems on structural steelwork, for example, make up only a small proportion of the vast areas covered, but individually such failures can have a considerable adverse economic and nuisance value.

Independent inspection is now widely used on important coating projects for structural steelwork and helps to avoid a considerable amount of abuse and corner cutting that can occur during a coating application. Nevertheless, failures can still occur and in this paper the following major points are considered.

1. How far do the duties of a painting inspector need to extend beyond mere quality control measurements.
2. What training and experience is needed for a painting inspector.
3. Are the methods of measurement and assessment used sufficiently accurate for the purpose.
4. Does the paint industry give the painting inspector adequate help and information.

D. A. Bayliss

Biography

Derek A. Bayliss is managing director of the Steel Protection Advice Bureau, an independent advisory and consultancy service. He was formerly head of the Protective Coatings laboratory, Central Electricity Generating Board. Over the past years he has been President of the Institution of Corrosion Science and Technology, a Vice-President of OCCA and Chairman of the London Section of OCCA. He has served on many British Standards Institution committees and is Chairman of BSI Sub-Committee PVC 21/2 "Surface cleanliness of steel" and is the UK nominated expert on the International Standard on "Surface preparation for paint". He was a panel Chairman for BS 5493 "Protective coating of iron and steel structures against corrosion".

He has acted as coating consultant on many major projects in both the United Kingdom and overseas including the Middle East.

The use of modern application equipment and its efficiency

M. Eaton

Summary

The dramatic increase in the cost of petroleum-based products has made all paint users more aware that they are having to spend a great deal more money on painting their products to give them the required chemical/functional properties and decorative appearance.

By increasing paint utilisation/transfer efficiency not only will there be a material saving but also a reduction in the cost of treating the wasted paint from overspray and bounceback. Application efficiency includes transfer efficiency as well as the capability of the application system to apply the minimum quantity of paint to achieve the paint performance requirements of the product.

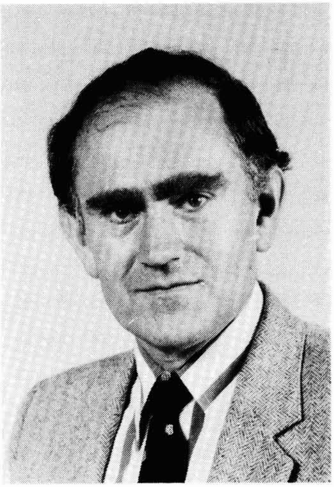
Various manual and automatic atomising methods of paint application will be discussed, showing their advantages and disadvantages with regard to their application efficiency for different shaped articles. The higher technology coatings such as high solids, water-based and two-component present particular problems for high application efficiency.

There are many constraints which have resulted in limited use being made of the more efficient manual application systems. A change to an automated system may not always show material savings.

Biography

Mike Eaton joined Pinchin Johnson & Associates in 1957 as a group trainee. He studied paint technology at East Ham Technical College and the Borough Polytechnic. He was awarded the City & Guilds insignia award in the field of paint technology. He was development and technical service manager of Robert Ingham Clark. With the formation of the

occa news



M. Eaton

Pinchin Johnson Industrial Division he became technical manager of their Special Products Division. In 1971 he left to start up the UK subsidiary of Kremlin France. In 1978 he helped to form the Spray Equipment Manufacturers Group of the Paint Research Association and has been its Chairman for the last three years.

Paint finishing in the car industry

H. L. Quick

The summary of this paper and Mr Quick's biography had not been received at the time of going to press. They should appear in the February issue.

Fire retardant coatings

D. M. Bishop, D. Bottomley and F. G. R. Zobel

Summary

Aesthetically acceptable fire retardant paint and varnish processes are required for refurbishing the interiors of railway passenger rolling stock. Assessment of application properties and fire tests are followed by suitable processes being subjected to large scale fire tests carried out in a modified railway coach. The problems highlighted are:

1. The poor flow and fire preventive properties of many commercially available paints, as far as the railway requirements are concerned.

2. That fire preventive properties can only be properly assessed in a "real fire" situation.

3. The nature of the finishing decorative paint or varnish can greatly influence the overall fire properties.

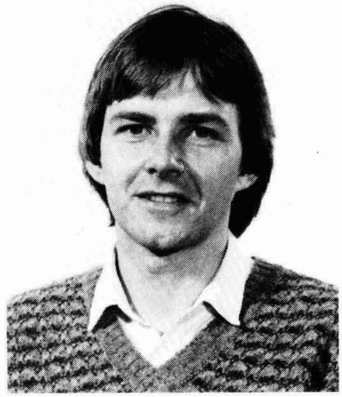
4. That new and special paint formulating techniques are necessary to achieve the railway decorative and fire preventive requirements.

This paper discusses the recent developments in fire retardant paint technology within British Rail based on realistic fire tests.

D. M. Bishop

Biography

D. M. Bishop graduated from Liverpool University in 1964 with an MSc in chemistry and joined British Rail Research and Development Division. At present he heads a section, within the Surface Coatings and Corrosion Unit, responsible for the day-to-day technical service work and the development of better "value-for-money" protective, decorative and fire retardant paint schemes for rolling stock, bridges, buildings etc.



D. Bottomley

Biography

D. Bottomley joined British Rail Research and Development Division in 1970 and on promotion moved to the Surface Coatings and Corrosion Unit in 1974, having worked in the Analytical and Material Sciences Unit and become an AMICorrT. Since 1974 he has been involved in the day-to-day service work and development programmes associated with the painting requirements of a Railway Industry.

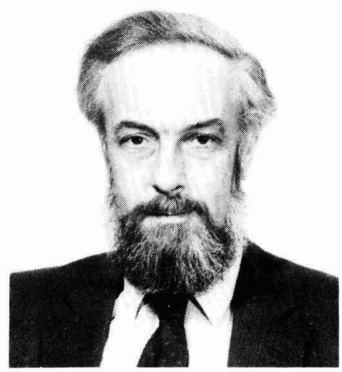
Biography

F. G. R. Zobel graduated in 1960 and received a PhD in 1963 in electrochemistry from the University of Bristol.

He spent two year periods at the University of British Columbia, Canada, Unilever Ltd in Cheshire and English Electric Co. at Stafford, working on surface chemical problems from detergents to thin film transistors.

He joined British Rail Research and Development Division in 1969 and engaged in various projects involving surface phenomena.

Dr Zobel became head of the Surface Coatings and Corrosion Unit in June 1978.



F. G. R. Zobel

Report of Council meeting

OCCA news

A meeting of the Council took place at 2.00 p.m. on Wednesday 27 October 1982 at the Great Northern Hotel, King's Cross, London, N1 with the President (Mr D. J. Morris) in the chair. There were 24 members present.

It was reported that since Mr J. Toovey had moved to London the position of Chairman of the Scottish Section had been taken by Mrs A. McA. Gibson and that Mr A. McKendrick would serve on the Council as the Section Representative. The President welcomed Mrs Gibson and Mr McKendrick to the meeting; Mr Toovey attended part of the Council meeting by invitation.

Mr F. Morpeth had accepted an invitation to serve on the Exhibition Committee. Mr A. J. Ford would be retiring from the Paintmakers Association Hazardous Substances Advisory Committee and it was agreed to appoint Mr J. W. Wenham as the Association's representative. Mr D. S. Newton was appointed the Association's representative on the National Council of Corrosion Societies. Dr J. G. Gillan wished to retire as the Association's representative on the City and Guilds Advisory Committee for the Chemical Technicians Certificate and it was agreed that no replacement should be made. Details of changes on BSI Committees structure were noted.

Details were given of the arrangements for the Association's Conference at York, 15-18 June 1983, including the technical papers for the four sessions. Council congratulated the Honorary Research & Development Officer (Mr J. R. Taylor) on the comprehensive range of papers which he had arranged. It was agreed to maintain the same registration fees for members of the Association as for the Bath Conference in 1981, since it was hoped that this would encourage greater participation by members. The brochure giving the list of lectures and the social programme, together with the registration form would be despatched to members with the December issue of the *Journal* and full details of summaries of papers and biographies of lecturers would be appearing in the *Journal* in the New Year. Section chairmen were asked to consider if it would be possible to arrange coach parties from their sections for those wishing to apply for daily registration; a note would be added to the registration form so that members wishing to avail themselves of this facility could indicate this when registering for the Conference.

The half-year accounts and estimates for the second half of the year were adopted by the Council and it was reported that the subscription rate for non-members wishing to purchase the *Journal* for company libraries etc. had been raised to £50 with effect from 1 January 1983 and that increases had been made in the advertising rates for the *Journal*, the last adjustment having been made in May 1980.

Details were given of the removal from the Register of the names of members still in arrears with their subscriptions and Council were pleased to note that the total removed was slightly less than in October 1981.

It was reported that a number of sales had been made as a result of the special notice to members offering a reduction on certain of the Association's publications for a limited period during the summer. Members of the Honorary Editor's Advisory Committee had made visits to companies and three special items would be appearing in the *Journal*. Consideration was being given to some changes in the format of the *Journal* for 1983 so as to effect a saving in the cost of production.

Council were reminded that the Jordan Award would normally be presented at the York Conference and that applications by members under 35 years of age should be sent to the Director & Secretary by the end of 1982.

It was reported that two Associates and one Licentiate had been admitted to the Professional Grade.

Reports were received from sections on their activities and of particular interest was the report from the Ontario Section regarding the progress made in their Technology Course. The President reported on his visit to the South African Division Symposium and on the feelings of the Division supporting the OCCA International concept.

The Council then discussed at considerable length the future activities of the Association in respect of exhibitions and it was confirmed that no exhibition would be mounted in the Spring of 1983 but that, subject to a suitable agreement, the Association would sponsor a major theatre-style exhibition in 1985, which would be organised by International Symposia and Exhibitions Limited, an Industrial Newspapers PLC company.

There being no other business, the President thanked members for their attendance and declared the meeting closed at 5.00 p.m.

Thames Valley Section

Harvey's sherries

The first meeting of the season held on 26 September 1982 at the Crest Motel, Beaconsfield was as usual a social event, the speaker being Mr Tom Thornton of J. Harvey and Sons on sherries.

Mr Thornton began by outlining the history of sherry and describing the area from where it originates, and went on to explain the method used to make sherry, from the planting of the vine to bottling. Members were told of the continuous blending process used in the manufacture of sherry, the Solera system, and then given the chance to sample the differences between the two main types of sherry, Fino and Oloroso, as well as the virtues of a new type of sherry soon to be marketed.

Vincent Moore concluded with a vote of thanks for a most enjoyable evening.

R. L. Stephens

Obituary

H. R. Touchin

M. H. M. A. writes:

For the last 15 years or so Roy Touchin and I were in regular contact and frequent collaboration. During that time I became more and more impressed with his abilities – not as a paint technologist, for that was well known, but as an applied scientist in the true sense of the phrase. He was no narrow specialist but a down-to-earth practical scientist, ready to tackle any problem as it came along, and with a shrewd appreciation of the difference between the laboratory bench and the North Sea winter – for he came to be one of the world's leading consultants on the protection of oilwell-drilling equipment, both in northern Europe and Arabia. Besides this, he was a powerful expert witness, all the more convincing for his combination of authority and modesty. Of Roy's musical work I am not qualified to speak – except to know that he could have made this his full-time career had he wished.

M. H. M. Arnold

occa news

Manchester Section

Annual dinner dance and ladies' night

The annual dinner dance and ladies' night for 1982 was held on the night of Friday 15 October 1982 in the Peacock Suite, Hotel Piccadilly, Manchester. This year's event was attended by a magnificent total of 341 members and their guests.

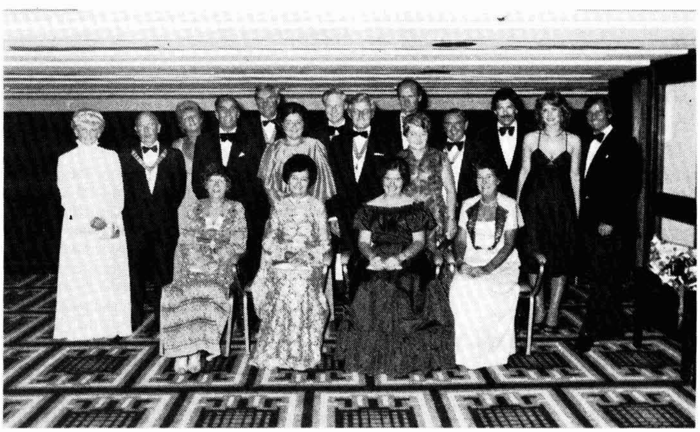
The principal guest was Mr Fred Lewis, CChem, FRIC, FTSC, chief executive of Wallcoverings Division, Reed Decorative Products Ltd, accompanied by his wife, Edith. Other guests occupying the top table were: Mr Dennis Gibson and Mrs Anne Gibson (Chairman Scottish Section); Mr Douglas Pountain (Chairman Irish Section) and Mrs Kathleen Pountain; Mr Ron Chappell (Chairman West Riding Section) and Mrs Ann Chappel; Mr Alan Watson (Chairman Newcastle Section) and Mrs Mima Watson; Mr Brian Gilliam (Chairman London Section) and Mrs Stephanie Gilliam; Mr Robert Hamblin (Director & Secretary).

To welcome the guests to the Manchester Section function, propose the toasts and respond accordingly were Frank Redman, Chairman Manchester Section, and Mrs Peggy Redman. Assisting Frank was Gordon Robson, Vice-Chairman Manchester Section, and Mrs Joyce Robson.

The excellent dinner consisted of five courses and for those present who decided to counter the effects of gregarious gluttony, exercise was available on the dance floor until way past the bewitching hour. As in previous years the Satin Brass Group provided the musical score.

To end this report on a historical (not musical) note, we hope to repeat this year's success in 1983 with the continuing assistance of our Social Secretary, David Wilcox.

F. B. Windsor



Shown at the Manchester Section's annual dinner dance and ladies' night are: (standing left to right) Mrs K. Pountain, Mr D. Pountain (Chairman Irish Section), Mrs A. Chappell, Mr F. Lewis (Principal guest), Mr R. Chappell (Chairman West Riding Section), Mrs S. Gilliam, Mr B. Gilliam (Chairman London Section), Mr F. Redman (Chairman Manchester Section), Mr D. Gibson, Mrs M. Watson, Mr A. Watson (Chairman Newcastle Section), Mr D. Wilcox, Mrs M. Coop, Mr G. Robson; (seated left to right) Mrs A. Gibson (Chairman Scottish Section), Mrs E. Lewis, Mrs M. Redman and Mrs J. Robson

London Section

Kekwick Prize

On Thursday 21 October 1982, prior to the start of the 2nd technical meeting of the session, the Chairman of the section, Mr B. F. Gilliam, presented the 1982 Kekwick prize.

The recipient was Mr T. J. Miles of Cray Valley Products Limited who was awarded the prize of £25 for his success in obtaining distinctions in both parts II and III of the City and Guilds of London Institute Chemical Technician's course.

A. J. Newbould

professional grade

Important notice

Inadvertently at the final printing stage, the names of the following Fellows were omitted from the list of Professional Grade members printed on page 455 of the December 1982 issue of the *Journal*.

Bosman, Herman Izak *(Transvaal)*
Bourne, John Robert
(Midlands – Trent Valley Branch)
Bridle, Peter Frederick *(London)*
Brooks, Leo James *(London)*

We apologize to the members concerned for the inconvenience caused.

new members

The section to which each new member is attached is shown below in italics.

Ordinary Members

Akam, R. B. *(London)*
August, A. E. *(Natal)*
Beukes, H., BSc *(Transvaal)*
Burns, N. A., BSc *(Manchester)*
Craddock, R. S. *(Cape)*
Dijkhuis, C. G. M., Dr Phys. Chem. *(General Overseas – Netherlands)*
Gottlieb, A., BSc *(General Overseas – Denmark)*
Gray, S. M., BSc *(Natal)*
Lamb, B. C. *(Manchester)*
Lancaster, K. *(Transvaal)*
McVie, J., BSc, PhD *(Bristol)*
Munnoch, P. J., BSc, PhD *(General Overseas – Taiwan)*
Nichols, D. G. *(Natal)*
Nundeekasen, A. S., BSc *(Natal)*
O'Rourke, P. J. *(Manchester)*
Otiend, C. R. *(General Overseas – Kenya)*
Radford, P. G., BSc *(Manchester)*
Sen, R., BSc *(General Overseas – USA)*
Shanmuganathan, S. *(Midlands – Trent Valley)*
Shaw, B., BSc *(Natal)*
Song, Y. M. *(General Overseas – Malaysia)*
Tilak, G. Y., BSc, MSc *(General Overseas – India)*
Walmsley, W. W., BSc *(Manchester)*
Yassa, K. *(Transvaal)*

Associate Members

Colepeper, N. F. *(Natal)*
Hamilton, B. K. *(Transvaal)*
Kirk, R. D. *(Natal)*
Miller, R. G. *(Natal)*
Nicholson, B. A. *(Manchester)*
Seng, K. H. *(General Overseas – Indonesia)*

Registered Students

Gibson, C. S. *(Cape)*
Hotchkiss, S. I. *(Scottish)*
Johnson, M. A. *(Zimbabwe)*
Kelly, A. D. K. *(Cape)*

CLASSIFIED ADVERTISEMENTS

CONSULTANCY ON OFFER

Established consultancy vacant

Would suit redundant paint technologist

Apply: Touchin Technical Laboratories,
Carne House, Parsons Lane,
Bury, Lancashire BL9 0JT

Touchin Technical Laboratories

CALL FOR PAPERS

FATIPEC 1984

The Swiss Colour and Paint Chemists' Association is calling for papers to be presented at the XVII FATIPEC Congress to be held at Lugano from 23-29 September 1984. The theme of the congress will be "Coatings, paints and printing inks – today and tomorrow".

For further information contact:
Erich V. Schmid, Höhenweg 13, CH-9000 St Gallen, Switzerland.

SITUATIONS WANTED

Experienced technical sales representative

seeks work with a raw materials supplier to the paint, surface coatings, ink and allied industries. Preferably north or Midlands.

Please write to Box No. 525

Member Seeks Position

Member with director experience age 57 seeks employment. Wide technical experience in speciality coatings for paper and film, vacuum metallising, management and sales.

Replies in confidence to
Box No. 518

Industrial Chemist

Industrial chemist surface coatings (33 years old) qualified to LRSC, HNC in polymer science with ten years experience in paints and resins and overseas experience seeks employment in this field. Willing to work in UK or overseas. Has experience in development, quality control, and management.

Replies to Box No. 523

APPOINTMENTS

PAINT MANUFACTURING CONTROLLER

Bristol Paint Pty Ltd, which is located in Melbourne, Australia, was established in 1938 and supplies architectural paints which are sold only through its own chain of 47 retail outlets known as Bristol Decorator Centres.

The Company, which is privately and independently owned, operates outlets in three states of Australia and has built up a sound reputation for the quality of its products.

The Company, which is growing, is seeking a suitable person to control its manufacturing operations currently producing 6 million litres of paint per year.

The person we are seeking will possess a tertiary qualification and will have a minimum of ten years successful experience with a proven record of management skills.

Responsibilities cover the efficient management of both the manufacturing centre and the technical paint laboratory.

The person selected will become a member of the core Executive and will respond directly to the Managing Director.

This is a challenging position which calls for a deal of creativity and dedication.

An appropriate salary package will be negotiated along with reasonable relocation expenses.

Confidential written applications should be submitted to:

Bristol DECORATOR CENTRES

G. S. Phillips
Managing Director
Bristol Paint Pty Ltd
PO Box 345
Glen Waverley, Victoria
AUSTRALIA 3150
Telex: (KEMREZ) AA33367

PAINT CHEMIST SECTION LEADER WANTED

Company situated in an attractive area in SE England, where housing is good, requires a paint chemist as section leader. Excellent conditions and prospects.

All replies treated as confidential. **Box No. 524**

JOURNALS ON OFFER

JOCCA January 1948 – September 1982 (April, May and June 1950 missing)

Journal of Paint Technology January 1952 – December 1974 all in good condition.

Offers to:
H. A. Shelton, 495B London Road, Oxford OX3 8DP
Tel: 0865 62794

APPOINTMENTS

PAINT TECHNOLOGISTS/TECHNICIANS

The South African Bureau of Standards, an organization engaged in the promotion of effective standardization and quality management for commerce and industry, which operates from a comprehensively equipped head office complex in Pretoria, South Africa, has the following vacancies in the Paints and Sealants Division:

1. EXPERIENCED PAINT CHEMISTS with preferably university or equivalent qualifications plus a substantial number of years' experience in the paint field, are required. Professional grading in OCCA will be a strong recommendation.

   The posts offered cover a varied and interesting field including drawing up of specifications for all types of coatings, sealants and paint systems, investigating field complaints, developing test methods, and consultative work.

2. TECHNICIANS are required for the general paint laboratory. The work encompasses accelerated and natural weathering tests, salt spray and humidity cabinet plus cathodic disbonding corrosion testing, together with all the normal varied testing of all types of organic coatings. A knowledge of sealants will be a recommendation since polysulphide, polyurethane, silicone, bituminous and oleoresinous sealants are also tested.

In addition to competitive salaries, the Council offers excellent fringe benefits which include: ● free air passage for you and your family ● generous assistance with relocation expenses ● up to 56% of house mortgage is paid (for breadwinners) ● a 13th salary cheque bonus ● up to 42 days' annual leave (6 weeks) ● pension, medical and group life insurance schemes.

Please send a full curriculum vitae to The Scientific Counsellor, Chichester House, 278 High Holborn, London WC1V 7HE. Tel. No. 01-242-1766.

Suid-Afrikaanse Buro vir Standaarde
South African Bureau of Standards

DM&M RJ0084

E. G. BERBERI FRERES

A new branch for chemical research has been created by the Development and Process Division of E. G. Berberi Freres in order to welcome a further paint technologist devoted mainly to chemical research in a full range project.

Terms: Salary will be based initially upon experience followed by either a BSc or MSc in chemical technology or a BSc in chemistry with a knowledge of polymer chemistry.

Apply: Telex *EGBF 40186 LE* or write for an application form to: *E. G. Berberi Freres – PO Box 90389 – Jdeidet el Metn – Lebanon.*

SITUATIONS WANTED

LABORATORY MANAGER

CChem, MRSC/ATSC. 21 Years experience of aerated concrete, concrete admixtures, corrosion protection, and surface coatings: would like to hear from a company who might be able to use the above experience.

Replies to Box No. 519

TECHNICAL ADVISER AND MANAGEMENT GRADUATE

with 10 years experience of aerated concrete, surface coatings etc, would like to hear from a company which might have suitable vacancies.

Replies to Box No. 520

LABORATORY TECHNICIAN

19 years old, TEC 3 chemistry, experience of corrosion, concrete and paint testing. Excellent references. Would like information on possible jobs in SE England.

Replies to Box No. 521

JOCCA

READER ENQUIRY SERVICE JANUARY 1983

Name . . . .

Job Title . . . .

Company . . . .

Address . . . .

. . . .

. . . .

Country . . . .

Telephone . . . .

For further information on adverts or editorials enter the Reader Enquiry Service Number/s below. This enquiry will be forwarded to the company/ies concerned.

Photocopy or cut out this form and send to:

JOCCA

Priory House, 967 Harrow Road, Wembley, Middx., HA0 2SF, England
Telephone: 01-908 1086
Telex: 922670 (OCCA G)

INDEX TO ADVERTISEMENTS

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.

A

Astec Environmental Systems Ltd . . . . (229) i
Atlas Electric Devices Co . . . . (157) Cover

E

ECC International Ltd . . . . (101) Cover

I

ICI Organics . . . . (225) v,vi,vii,viii

O

OBS Machines Ltd . . . . (108) i
OCCA Australia Convention . . . . (230) ii

P

Pacific Scientific . . . . (176) vi
Pearson Panke Equipment Ltd . . . . . . (189) xii
Pigment International . . . . (228) Cover

S

Sachtleben Chemie GmbH . . . . (116) ix
Sanyo-Kokusaku Pulp Co. Ltd . . . . . . (112) ii
Speed Electrics . . . . (231) xii
Sub-Tropical Testing Service Inc . . . . (117) Cover